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Editorials

THE COLONIAL EMPIRE AND VETERINARY SCIENCE.

In a speech made before the 26th Annual Dinner of the Corona Club on May 6th, Mr. Amery, the Colonial Secretary, said that " He hoped before many years were out to make the Colonial Empire a model to all the world as regards development of Agricultural and Veterinary Science. They were still only in the beginning of their efforts in the field of health. But no task before the Colonial Office could be greater than that of proving itself a real Ministry of Health to the tropical world."

CASEOUS LYMPHADENITIS IN SHEEP.

In our Editorial for March we drew attention to the question which had been raised in Parliament in regard to the importation of mutton suffering from Caseous Lymphadenitis, and we also drew attention to the statement that between December, 1928 and February, 1929 over 21,000 sheep carcases out of a total of 284,000 were found, upon

veterinary inspection, to be suffering from this disease; over 17,000 being discovered in the London district. By an error the impression was given that these came from New Zealand; whereas, although the disease is known in that country, the proportion found in New Zealand carcases was very small indeed—in fact out of 3,000 carcases examined only two were found to be affected.

HUMANE SLAUGHTERING AND SPLASHING.

THE subject of the cause of "splashing" of the flesh of pigs has received a fresh impetus by an original research and report upon the subject by the well-known authority and expert, Mr. Thomas Parker, F.R.C.V.S., the Veterinary Officer who is in charge of the abattoir at Newcastle-upon-Tyne. Although an article of length, we publish it in full, as every part of it is of interest to both student and practitioner, and Mr. Parker has followed up the subject in a detailed manner which has enabled him to be emphatic in his assertions and conclusions.

To the third year or final student, about to present himself for the Examination of the Royal College of Veterinary Surgeons, it is likely to prove most useful, and for the practitioner who is already installed as one of the guardians of the public welfare, it will prove most interesting reading.

Mr. Parker has carefully studied the various ways of killing, and applied his knowledge to a practical result; as the opinions which he gives in this article are not only the result of his own unbiased observations but are also deductions carefully made in the light of a mature judgment.

However, our readers will be able to read it for themselves, with, we are quite sure, the necessary frame of mind to be able to judge the question of "splashing" amongst other things, impartially and in English fashion.

General Articles

HUMANE SLAUGHTERING AND SOME EXPERIMENTS BY VARIOUS METHODS OF STUNNING, WITH SPECIAL REFERENCE TO THE CONDITION KNOWN AS SPLASHING.

By THOMAS PARKER, F.R.C.V.S.

Veterinary Officer for the City and County of Newcastle-upon-Tyne.

DURING recent years the question as to whether the use of mechanically-operated instruments for stunning purposes should be made compulsory and applicable to all animals slaughtered for food purposes is one that has given rise to a considerable amount of discussion. Some hold that mechanical slaughtering has no advantage over the traditional methods in the prevention of unnecessary suffering ; others believe that by the use of mechanically-operated instruments the carcasses may be seriously deteriorated, whilst there are many who contend that the ordinary method of killing is much more humane than the Jewish method. As the subject is somewhat complicated, it is proposed to briefly refer to some of the difficulties in stunning, some differences from the humane standpoint of the various methods of killing, and submit some explanations as to the probable causes of splashing and other forms of faulty bleeding, besides illustrating, by a description of experiments on sheep and lambs, the methods by which, during the use of mechanically-operated instruments, they can best be eliminated.

Some Difficulties in Stunning.

Difficulties are more likely to arise in the stunning of large boars and sows than with the other larger animals such as cattle. As an example, one may refer to a complaint the author received during October of last year concerning the slaughter of a large sow.

It appears that a captive-bolt instrument was used in two successive attempts to stun and in each instance the bolt failed to penetrate the skull. Whether or not, on this occasion, the bolt was suitably adjusted and the proper strength of cartridge used, or the aim was properly directed, are matters concerning which one has no definite information. The slaughterman who killed the animal and dressed the carcass states that after the captive-bolt instrument had failed

the animal was stunned with the hammer, but did not fall until after five blows had been delivered. This case illustrates the type of animal one may expect to find periodically when slaughtering old or large boars and sows, but may be regarded as an exception to the rule. Owing to the peculiar shape of the skull, the enormous development, denseness and toughness of the frontal bones and the comparative smallness of the brain in some of these animals, it is well nigh impossible to stun them without the deliverance of several blows which only succeed by gradually breaking down the parts struck, thus permitting penetration of the brain.

In some parts of the country pigs are always bled without previous stunning, the animal being suspended by a chain attached to a hind limb and then stuck while in that position. Within this City, however, it has always been the practice in pig killing to stun the animals before sticking. When dealing with small pigs the slaughterman frequently stuns one or more while they are lying down, standing or attempting to escape amongst their fellows. The stunned animals are then pulled out from amongst the others and bled on the slaughterhouse floor. When the animals are not under proper restraint the part of the skull aimed at may be missed and that is one of the reasons why felling with the hammer fails, from time to time, to stun the animal at either the first or second attempt. When a large pig, such as a boar or sow, is about to be stunned, the head is invariably steadied by means of a rope attached to the upper jaw. When failure to stun any of these animals either at the first, second, third or even the fourth blow of the hammer occurs it is usually because the slaughterman, although correctly aiming each time, is physically incapable of breaking through the skull towards the brain owing to the enormous resistance offered by the dense bony tissue.

The object of stunning as the first act in the process of killing is, of course, to render the animal unconscious instantaneously and thus eliminate the possibility of unnecessary suffering. To achieve that object the animal must be so controlled that when the slaughterman proceeds with the stunning it is unable to suddenly move its head from the desired position. Cattle are usually secured head downwards by means of a rope attached to the neck as a slipknot, the free end being passed through a ring on the floor, drawn tightly and made secure to some fixed object. With reasonable care there should be no difficulty in securing cattle in the desired position for stunning, not only with comfort to the animal, but with safety to the slaughterman, providing the premises in which the animals are to be slaughtered are properly arranged.

It is scarcely necessary to refer to the methods of restraining sheep

and lambs, for they are comparatively easy to handle. In the matter of securing for the purpose of killing, pigs undoubtedly give the greatest amount of trouble. Perhaps one of the best and most certain methods of securing pigs is by the use of what is known as the Dutch pig trap. When used in a modern pig killing abattoir, the animal is driven from a pen through a doorway leading into the trap. By operating a lever the animal is immediately suspended with all feet off the ground, the whole body, including the head, being immobile. In this position the animal is stunned after which by again operating a lever, the body is tilted on to the floor where it is stuck.

Unfortunately, the arrangements within the majority of small private slaughterhouses do not permit of the use of these appliances, and it is certain that so long as pig slaughtering is permitted under such conditions so long will much unnecessary suffering occur.

The Advantages of Mechanically-Operated Instruments.

No matter what our individual opinions may be as to the comparative values, commercially, of the various methods of slaughtering practised in different parts of the country, it is scarcely possible to dispute that the most humane method of killing any animal is that which brings about instantaneous unconsciousness as the first act in the process.

In slaughtering one of the large animals, such as a bullock, providing the animal falls unconscious at the time the first blow with the hammer or pole-axe, or the penetration of the brain by the captive-bolt of a shooting instrument, has occurred, it may be considered that insensibility has been produced instantaneously. On the other hand, when a similar animal, after being secured by ropes in the desired position, is slaughtered by the Jewish method, it is possible and it is usual for the throat to be cut in such a manner that the operation may be considered to have been performed almost instantaneously. It must be remembered, however, that by this method not only is it necessary to cut through about nine inches of hide, crosswise, but also to sever the windpipe (trachea), gullet (œsophagus), muscles on either side of the neck and the large blood vessels, and nerves, thus causing a gaping wound extending across the throat from ear to ear. Whilst unconsciousness by this method, cannot be said, to occur instantaneously, it does, nevertheless, quickly follow the rapid expelling of blood, and the cutting off of the main circulation to the brain. If, then, one compares the two methods of killing, from the point of view of humane slaughtering alone, that which requires stunning before bleeding is much to be preferred to the Jewish method, for the reason that by the former the animal is rendered unconscious at the moment the pole-

XUM

axe strikes the skull or the bolt enters the brain, whereas by the latter method the animal is conscious at the time the skin, muscles, trachea and other tissues of the throat are cut.

If the act of cutting the throat by the Jewish method be imperfectly done then a greater amount of pain will be inflicted and the period elapsing between the act of cutting and the onset of unconsciousness may be extended. Again, when, by reason of accident or otherwise, the first two or three blows delivered to the skull with the pole-axe fails to stun the animal, a certain amount of pain must of necessity be inflicted. Not only by this method but also by the Jewish method, the prevention of the infliction of unnecessary pain during the act of killing depends almost entirely upon the physical ability, skill, and care of the slaughterman, providing, of course, that the premises in which the slaughtering is carried out are suitably arranged, roomy, well lighted and fully equipped with the essential appliances.

To stun large bulls, bullocks, boars and sows requires, as a rule, more than average strength and dexterity on the part of the slaughterer. Some men are almost always physically fit ; others vary from time to time. Occasionally, even with expert and physically fit slaughtermen, when a blow is about to be delivered for the purpose of stunning, the animal, being somewhat wild or restless or imperfectly secured, suddenly moves the head, the result being a most undesirable scene. Men become expert by practice, and from the moment the youth commences as a mere novice, until he has served his apprenticeship and become an expert, he obtains his experience within the slaughter-house upon living animals so far as the process of killing is concerned. Human nature being what it is, there are varying differences between individuals concerned in any particular business.

Some youths rapidly become expert slaughterers ; others with years of experience with great difficulty pass the novice stage. With most individuals concerned, the question of physique, temperament, training, and mode of living, combined, largely determines their success or otherwise as slaughtermen.

It would appear certain that, by partly eliminating the human element, something short of these conditions would suffice and yet prove successful and more reliable were the force required for the stunning of animals exerted by mechanical means only. This would appear obvious for several reasons, namely :—

I. An instrument being mechanical will operate the same way on each successive occasion ;

II. The power exerted for the purpose of stunning does not depend upon physical fitness ;

XUM

III. The amount of skill required to operate an instrument may be small and acquired from the outset ; and

IV. An instrument may be used with success from the outset without sacrificing any animals for practising purposes.

These observations, of course, are based upon the assumption that the instrument employed is a perfectly suitable one and capable of easy adjustment.

The Various Methods of Killing and their Relationship, Physiologically, to Bleeding and the Condition of Dressed Carcasses.

When a healthy animal is slaughtered, the method of killing, whether one or other part of the central nervous system be injured or destroyed prior to bleeding, or whether bleeding be performed in the absence of any such injury or destruction, will have an important bearing on the efficiency of bleeding and therefore the appearance of the dressed carcass.

In order to have a clear conception of the probable causes of the results obtained in the experiments to be described, it may be of advantage to briefly refer to that part of the nervous system known as the brain, which may be conveniently considered as consisting of three sections, namely :—

I. The cerebrum (two large rounded masses of brain tissue) which is placed beneath the frontal bones or fore head, the part of the skull struck in the process of stunning cattle ;

II. The cerebellum (two small lobes immediately behind the cerebrum) ; and

III. The medulla, situate immediately beneath the cerebellum. It appears like an expanded portion of the spinal cord and forms the connecting link between the latter and the brain.

I. The Cerebrum. In this part of the brain are situated the centres having to do with impressions, painful or otherwise. Indeed, the seat of these centres has been aptly termed the main sensory station. For example, should an animal receive a prick, blow, cut or other form of stimulus on some part of its anatomy, an impression will instantly pass from the injured part along the nerves, through the spinal cord and medulla, and be recorded in the cerebrum, thus making the animal aware of the fact, no matter whether the impression be one of indifference, pleasure, alarm, or pain, severe or otherwise.

When an animal is slaughtered by stunning, the concussion caused by the blow of the hammer or pole-axe or by the captive-bolt penetrating the brain puts the main sensory station either temporarily or permanently out of action, thus rendering the animal unconscious. Again, bleeding by the Jewish method, or the ordinary method of

sheep sticking, is rapidly followed by unconsciousness because of interference with the regular flow of blood through the vascular system without which the brain ceases to function.

Now, it has been computed that the blood may circulate through the carotid artery at the rate of about a foot per second and that when such a vessel has been opened it may escape at a speed of from five to ten times as great. It is conceivable, therefore, that the time occupied in the onset of unconsciousness in an animal bled without previous stunning will be more or less controlled by the quickness and completeness with which the operation of severing the large blood vessels in the region of the throat is performed. For the latter reason, slaughtering by bleeding without previous stunning, whether by the Jewish or any other method, should not be permitted unless the method and instruments used are such that the vessels and adjoining tissues can be completely severed almost instantaneously. But no matter how near the state of perfection the slaughterman may have arrived in the art of cutting or sticking, the infliction of a certain amount of pain, even if only momentarily, will be inevitable from time to time where slaughtering without previous stunning is carried out.

II. The Cerebellum, so far as this subject is concerned, is not of particular interest.

III. The Medulla. The circulation of blood within the body of an animal depends, for its regularity and power, on certain mechanisms, each acting in harmony one with the other. For example, the heart, which may be regarded as the pumping station, is engaged continuously in forcing blood in one direction while, at the same time, receiving it from another. This circular distribution is a continuous one and may amount to the entire blood of the body passing through the heart of a bullock at least once in a little under a minute. In accordance with whether the heart is more, or less, active, the small blood vessels accommodate matters by contracting or dilating; thus raising or diminishing blood pressure.

The activity of the various muscles of the body and limbs assist the flow by squeezing the blood along the veins, and amongst the most important are those concerned in respiration. As the capillaries or minute vascular spaces joining the arteries and veins are somewhat larger during exercise than during rest, the kicking with a free limb by an animal during slaughter is an important aid to good bleeding. The muscles concerning respiration, particularly the diaphragm (skirt and back collop) are all important factors concerning blood circulation. As the centres controlling the mechanisms so important to life, such as respiration, circulation and the heart's action, are all lodged within the medulla it will be apparent that no matter by what method an

XUM

animal is being slaughtered, the efficiency and completeness of bleeding and the consequent appearance of the dressed carcass will more or less depend upon the extent to which, and at what stage, the medulla has been interfered with.

Killing by Stunning followed by Bleeding.

In felling an animal with a hammer, pole-axe or heavy mallet, the concussion occasioned by the impact opposite the brain results in the animal suddenly falling in an unconscious condition. Providing the concussion has been just sufficient to cause unconsciousness and nothing more, the heart beating, breathing and blood circulation may continue. Indeed, providing the animals were not bled, many in such circumstances would recover. When the vessels are cut after stunning, the animal bleeds freely and well, death taking place before the recovery of consciousness. Sometimes the slaughterman delivers the first blow with the spiked end of the pole-axe ; when he stuns the animal in the usual way, that is by using the flat side of the head of the pole-axe, he invariably follows this up by delivering several blows with the spiked end to pierce the skull. Further, it is usual to complete the felling by passing a cane or wire through the opening made towards the spinal cord, thus injuring or destroying the medulla. When this occurs the animal is immediately paralysed, less likely to struggle and easier to stick ; and if not bled, would simply die from asphyxia. By destroying the medulla after stunning, but prior to the process of bleeding, one is thus deliberately interfering with the heart's action, respiration and circulation and therefore further hampering the possibilities of perfect bleeding. These, then, are the methods pre-prevailing in the slaughter of cattle, and have been practised for ages without any question as to good, bad, or indifferent bleeding, or their effects on the condition of the dressed carcasses.

Again, when an animal is stunned by a blow with the hammer, one must not suppose that the concussion caused is confined to the cerebrum or large brain. As the different sections of the brain are in close contact one with the other, it would appear certain that a degree of concussion, proportionate to the severity of the blow and weight of the hammer, will be passed on to the medulla and surrounding structures before being finally lost.

By slaughtering an animal with a mechanical killer liberating a free bullet, the latter, after penetrating the cerebrum, often destroys the medulla in continuing its course, thus stunning and paralysing at one and the same time. When, however, the captive-bolt pistol is used for stunning, the bolt simply penetrates the skull and cerebrum, but is automatically withdrawn before the animal has had time to fall.

XUM

The possibility of some concussion being passed on to the medulla by this method also should not be overlooked.

It will be observed from what has been stated that by the use of the felling-hammer, pole-axe, or the captive-bolt pistol, stunning is effected by concussion primarily affecting the cerebrum ; and when the animal has fallen in an unconscious and relaxed state a period elapses before any attempt to cause paralysis by pithing with the cane has been made, whereas by use of the free-bullet pistol, pithing and stunning may often occur at one and the same time.

At first sight, it might appear that some difference would occur in the appearance of the carcasses of animals slaughtered by the two methods described. Providing that bleeding is carried out promptly and efficiently, after each method, it may be shown that any difference occurring physiologically is so remote that in the appearance of the dressed carcasses, there is nothing by which any one may be distinguished from any other. The latter remark particularly applies to cattle, for whilst one never meets with cases of so-called splashing in the carcasses of these animals, one does, periodically, meet with cases amongst carcasses of pigs stunned with the ordinary felling mallet as well as those stunned with the mechanical killer.

The probable causes of splashing will be referred to in the description of that condition and in connection with sheep slaughtering experiments to be described later.

Killing by Bleeding without Previous Stunning.

This is the method by which Jews slaughter cattle and sheep. Each animal, after the limbs are secured, is laid upon its back with the head extended backwards exposing the throat region.

In some parts of the country pigs are killed by sticking, the animals being secured for the purpose by suspending them in the air by means of a chain attached to a hind limb.

As one would expect, splashing in carcasses of animals killed by bleeding only is unknown.

Killing by Bleeding and Pithing, without Previous Stunning.

This is the method by which butchers have slaughtered sheep since time immemorial. The animal, after being placed on a crate with the two fore limbs and left hind limb secured together by means of a thin rope and with the upper or right hind limb free, is stuck by completely piercing the neck with a sharp pointed knife, thus severing the large blood vessels. Some slaughtermen follow up the sticking by cutting the spinal cord in the region of the medulla with the point of the knife ; others pass the finger into the aperture made by sticking

XUM

and press the medulla, thus causing immediate paralysis. As unconsciousness by this method of killing, like the Jewish method, is the immediate result of cerebral anæmia, anything which interrupts the bleeding will, as a matter of course, tend to delay the onset of unconsciousness.

Now, as it has been previously explained, injury or destruction of the medulla, by interfering with the mechanism of the heart's action respiration and circulation, tends to retard bleeding, it is probable that an injury to the medulla by pithing may, notwithstanding the concomitant interference with respiration, delay to some extent the onset of unconsciousness. As bleeding by this method of slaughter is well established before pithing takes place, the effect of the latter is so infinitesimal as to have little or no practical bearing upon the appearance of the dressed carcass. Nevertheless, as the pithing of sheep cannot be claimed to be of any great advantage to the slaughterer, it is suggested, in the interests of the animals, that in all cases where slaughter by bleeding without previous stunning is permitted, the practice of pithing should cease.

Jewish versus Ordinary Method of Sheep Killing.

From the standpoint of humane slaughtering, the difference existing between these two methods may be said to depend on the time occupied in carrying out the operation and the condition of the knives used for the purpose. For example, by the Jewish method, an extremely sharp or razor-like knife, having a blade about 14 inches long, is used to cut the skin, muscles, blood vessels, nerves, and other tissues in the throat region. This operation is performed in an almost instantaneous manner by practically one stroke, whereas by the ordinary method the slaughterman, using an ordinary sharp pointed knife, quickly pierces the neck after which he turns the blade and then withdraws it sharply, whilst at the same time completing the cutting operation. Unfortunately, in some instances, insufficient attention is paid to the condition of the knife used, and the necessity for doing the operation quickly; and when this is followed by extending the head backwards in an attempt to dislocate the neck before finally inserting the finger into the wound to make an additional attempt to pith, the further amount of pain inflicted appears unjustified and could be prevented.

Whilst not contending that, from the humane standpoint, the Jewish method equals the method of stunning before bleeding, it would appear reasonable to suggest that before the ordinary method of sheep killing can be considered equal to the Jewish method, some modification or improvement will be necessary. For example, if

XUM

only extremely well sharpened and suitable knives were used in the slaughtering of sheep and lambs by the ordinary method, and that the sticking were carried out as efficiently and quickly as the process of cutting by the Jewish method usually occurs then, and then only, would the weight of evidence be in favour of the butchers when contesting their rights to be permitted to continue slaughtering those animals without previous stunning, so long as the Jewish method is permitted.

Killing by Pithing or Injury to the Medulla, followed by Bleeding.

Although the practice is not a common one, slaughtermen have been frequently observed, when killing cattle, to deliver a blow behind the head with the spiked end of the pole-axe. When this occurs the animal suddenly falls to the ground in a paralysed condition. As the animal, after falling, may remain quite conscious, the practice is a most objectionable one, and I feel quite sure that it is only necessary for butchers to realise how unwittingly unnecessary suffering may be caused to gain their voluntary co-operation in the abolition of such a method for all time.

The Disfigurement of Dressed Carcasses.

The possibility of carcasses being deteriorated, owing to disfigurement due to the presence of the so-called splashing, as a result of killing pigs, sheep and lambs by stunning before bleeding is a trade problem that has been raised from time to time. So far as sheep and lambs are concerned, this question never came into prominence until mechanically-operated instruments were used for stunning purposes. In all the cases investigated by the author, as affecting pig, mutton and lamb carcasses, in no instance was any carcass found either unfit for food or so seriously disfigured as to materially affect its market value. In most cases it was only necessary to remove the diaphragm, the part most commonly disfigured, to render the carcass indistinguishable from other normal carcasses. In the case of one or two sheep and pig carcasses, however, not only the abdominal walls, but also the shoulder and neck muscles, singly or combined, have been found slightly disfigured with streaked hæmorrhagic areas. Fortunately, such cases are not common even amongst those that are affected. Sometimes when pigs are stunned with the felling hammer, mallet or captive-bolt pistol, the animals fall with the hind limbs extended. When this occurs there may be rupture of the blood vessels in the iliac region, thus causing blood extravasation in the muscles between the leg and loin or either side, or both. This condition, the result of an accident, has nothing to do with either splashing or general congestion.

As far back as most people can remember, cattle and pigs have always been killed, within this district, by stunning with an ordinary

felling hammer and mallet, respectively ; but during the whole of that period no complaint was ever heard of regarding splashing. Notwithstanding this, however, although splashing is practically unknown in carcasses of cattle, cases have been known to occur periodically in the carcasses of pigs slaughtered by stunning with the ordinary felling hammer or mallet ; but in mutton and lamb carcasses of animals killed by the ordinary method of bleeding without previous stunning, the condition is practically unknown.

Finally, the results of the experimental tests to be described indicate that by promptly bleeding the animal after stunning by the proper method, whether by means of the mechanically-operated instrument or otherwise, the cause of the conditions complained of may be eliminated.

Experimental Inquiry.

Whilst opinions are found to differ in various parts of the country concerning splashing, there appears to be no explanatory literature on the subject.

Being far from satisfied as to the precise cause of splashing and, in many cases, of imperfect bleeding in dressed carcasses, and knowing that some confusion or apprehension exists in the minds of many meat traders, regularly slaughtering their own stock, as to the probable trade risks involved by the use of mechanically-operated instruments ; it was felt that the subject was of such urgent importance as to demand further inquiry.

For these reasons, the slaughtering of a considerable number of pigs by various methods of stunning has been supervised, and an examination of the carcasses made. In addition, 384 experimental tests were made on sheep and lambs with a " Cash " captive-bolt pistol, the slaughtering being done by various methods.

As it was considered essential, particularly for the purpose of recording results, to be quite certain of the method of procedure in each case being carried out precisely as planned, the author deemed it advisable and therefore personally used the pistol in the slaughter of each of the 384 animals, directed and supervised the process of bleeding and subsequently made a close examination of each carcass.

In connection with the stunning of the 384 sheep and lambs no instance occurred in which the animal was not rendered unconscious instantaneously as the first act in the process of killing.

Splashing.

Splashing is the term commonly applied to a more or less disfigurement of dressed carcasses which takes the form of hæmorrhagic areas, chiefly characterised by their shape and regional distribution.

XUM

In pig, sheep and lamb carcasses it is commonly found confined to the tissues of the diaphragm, but may affect the internal surface of either the abdominal or chest walls. In pig carcasses it sometimes occurs as affecting the muscular tissues in the region of the shoulder and neck. When seen as affecting the abdominal walls, chest or neck region it often appears as dark coloured lines or streaks, giving the appearance of brush marks, or it may appear as a collection of spots varying in shape, not unlike those seen on an ordinary blotting pad. Similar hæmorrhages may be found, on cutting up the carcass, more deeply placed ; but this is much more rare.

When affecting the diaphragm, splashing may take the form of dark coloured islands or areas, some irregularly rounded, others more or less elongated. These vary in size from almost invisible dimensions up to the size of a sixpenny piece, and a quarter to half an inch in length respectively. Splashing, as described, appears to be a condition quite distinct from that ordinarily understood as imperfect bleeding. For example, just as splashing commonly occurs in carcasses extremely well bled so may carcasses be found imperfectly or badly bled and engorged with blood but with the complete absence of signs of splashing.

Again, when the condition does occur in carcasses properly and promptly bled, it is invariably so rare and of such dimensions as to have little or no bearing on either the appearance or market value of the carcass. On the other hand, when a carcass is badly affected, it will invariably be found that, irrespective of the splashing, the animal has been improperly bled, due to some error or delay of the operation, and particularly the latter. The sudden stoppage of the heart, respiratory and circulatory functions, because of injury or destruction of the medulla, has been referred to and an explanation offered that such might result from the concussion imparted by stunning, directly proportionate to the nature and extent of the impact. For example, if severe, besides the establishment of unconsciousness, the heart's action, respiration and circulation may have permanently ceased ; if less severe, there may be an effort on the part of these mechanisms to carry on only to fail after varying periods, whilst if not serious the animal would probably regain consciousness if not bled.

Bearing in mind these facts and also remembering that the capacity of the venous system is more than twice that of the arterial and that the veins, besides being less muscular, are less elastic than the arteries, it is conceivable that in accordance with the time elapsing between the stunning and the commencement of bleeding so will the degree of congestion and the presence of regional engorgement such as splashing be manifested in the carcass.

For example, when the large blood vessels are opened immediately

after stunning, the vascular and muscular pressure, and other factors already existing, are invariably sufficient to guarantee a complete and rapid flow of blood before stasis has had time to occur, regional or otherwise ; and when the bleeding has followed an injury or destruction of the medulla, such as pithing instead of stunning, the drainage might still be comparatively satisfactory with the exception that the carcass on close inspection may reveal more or less capillary congestion. Further, it matters not whether the animal has been felled by stunning or by pithing, if the period elapsing before the animal is bled be unduly prolonged, the carcass will be so congested in appearance that splashing, if present, may be entirely masked.

Again, after stunning, when the moment of bleeding, although not prompt, has not been sufficiently delayed to cause congestion, incompleteness of drainage may result in regional venous engorgement manifested by the so-called splashing ; and when it takes place after a similar period following some injury to the medulla instead of stunning, splashing, if present, will invariably be accompanied by more or less general congestion.

Cattle.

During October, 1925, for the purpose of a demonstration on various methods of slaughtering carried out within the City, four fat heifers, which were all about the same size, weight, age and breed and had been kept under identical conditions, were slaughtered by the following methods, namely :—

1. Ordinary method of stunning with felling hammer ;
2. Shooting by means of the " Greener Humane Killer " ;
3. Stunning by using a captive-bolt pistol ; and
4. The Jewish method.

After the carcasses had been completely dressed they were sectioned into sides and arranged in two rows suspended by overhead rails. On making a superficial inspection nothing was observed to distinguish them, one from the other. They appeared well bled and in first class market condition. On making a very close and prolonged inspection an attempt was made to place them in order of merit as to apparent perfection of bleeding, brightness and appearance generally. It should be noted, however, that both external and internal surfaces of the sides presented slight differences between the two sides of the same carcass. Moreover, slight differences were distinguishable between the fore and hind quarters of the same sides, besides between different parts of the same quarter. This applied equally in every case, and it may be added that the distinction between any two carcasses appeared in no case much greater than could be observed in one or two instances between two quarters of the same carcass. The slight differences

XUM

in appearance referred to are of little importance and usually pass unobserved.

The carcasses were eventually placed in the following order of merit :—

1st.	– Slaughtered by the Jewish method.		
2nd	– do.	do.	Ordinary felling hammer.
Equal	do.	do.	Captive-bolt pistol and "Greener Humane Killer."

Six days later, that is to say, on 12th October, 1925, the premises were again visited for the purpose of further inspecting the carcasses after sectioning the sides into quarters. In the meantime the beef had been kept hanging within the cooling chambers at the abattoir. For the purpose of inspection, one fore-quarter from each of the four carcasses was placed upon a table, the four quarters being arranged side by side so as to expose the newly cut surface of the first cut of the chine in each case. As in all the previous cases, when proceeding to place them in order of merit, it was not known by which method the animal from which any particular quarter was derived had been killed. After spending a considerable amount of time in attempting to place them in order as to merit, this was found practically impossible. Eventually one quarter was chosen as the best in appearance, the remaining three being considered as about equal. Whilst it was found that the quarter selected was from the heifer killed by means of the captive-bolt pistol, it should be noted that each of the four quarters appeared in faultless condition.

These demonstrations did little more than confirm the experience gained during a long period within the City. For example, during the past 22 years, approximately 40,000 prime bullocks and heifers have been slaughtered in one establishment alone by the use of mechanically-operated instruments. With the exception of a few hundred which were slaughtered during the past two or three years with a captive-bolt pistol, all were slaughtered with the "Greener Killer." In other slaughterhouses within the City several hundred cattle have been slaughtered during the past two years with a captive-bolt pistol.

It may be noted that the carcasses of these animals have been regularly inspected and at no time has anything been detected to distinguish them from carcasses of animals slaughtered in other establishments by the ordinary method. Moreover, no complaint has been received as to imperfect bleeding or the method of stunning.

Although it appears probable that carcasses of beef of animals slaughtered by the Jewish method may be amongst those most perfectly drained of blood, in actual practice, and all other things being equal, the method of killing—assuming each is properly carried out—

would appear to have little or no bearing on the general appearance of carcasses of freshly killed animals or the brightness, firmness or general commercial qualities of the meat when cut. In other words, if of a hundred bullocks or heifers an equal number were to be slaughtered by the four methods employed in the demonstrations, and, further, if the carcasses of these animals were cut into quarters or small joints and submitted to inspection by a Committee of Experts, it is certain that the latter would not find it possible to distinguish either the quarters or the joints by reason of a knowledge of the different methods by which the animals had been slaughtered.

Pigs.

With the exception of one carcass, which was examined within a wholesale meat shop, all were examined in one establishment where the animals were slaughtered under the author's supervision. A total of 315 carcasses were examined.

At the outset it should be noted that the length of time allowed to elapse in each case between the moment of stunning and commencement of bleeding was not taken, but this subject will be found dealt with under the heading of sheep slaughtering.

Number Slaughtered	Method of Stunning	Condition of Carcasses.
41 (including 5 sows)	"Cash" Captive-bolt pistol	Normal.
25	Temple-Cox Captive-bolt pistol	Two slightly splashed (hæmorrhagic spots on diaphragm). Remainder normal.
5 (all sows)	"Greener Killer" (free bullet)	Normal.
244	Ordinary Felling Hammer	Three were very slightly splashed; small hæmorrhagic areas being found in the diaphragmatic muscle. Six were slightly splashed; similar to above. Five were more extensively marked on the diaphragm, and in several of these the peritoneal surface exhibited streaked areas. In one, the diaphragm exhibited hæmorrhagic areas measuring up to 1″ in length by ½″ in breadth. The remaining 229 were normal.

It will be observed, according to the table submitted, that of the

pigs stunned with the ordinary felling hammer (the traditional method within the City) the percentage of carcasses found splashed was twice as great as that from pigs stunned with the captive-bolt pistol.

It should be noted that in those cases where only the diaphragm was discoloured, removal of the latter left the carcass in an apparently perfect condition. Apart from the splashing, the carcasses were all in splendid condition. When pigs are stunned with the felling hammer or pole-axe a considerable area of bruising and damage commonly occurs in the skull owing to the irregular breaking down of the bony tissues, but when the captive-bolt pistol is used, owing to the fact that only a clean puncture is the result, the dressed head is not only much better in appearance but of greater market value.

Sheep and Lambs.—Experiments on various Methods of Stunning and Bleeding.

These experiments were carried out between 31st October, 1928, and 16th January, 1929, a total of 384 animals being used for the purpose, comprising first class quality lambs and hogs from 7 to 10 months old, fully developed gimmers and wethers and large ewes.

The stunning was done with a " Cash " captive-bolt pistol by the following methods, namely :—

1. (a) By shooting through the cerebrum ;
   (b) ,, ,, ,, ,, ,, and directing bolt towards medulla ; and
   (c) By shooting through the medulla.

After stunning by each of the above methods, bleeding in each case was performed as quickly as possible.

2. By shooting through the cerebrum, bleeding being performed :—
   (a) After an interval of one minute ;
   (b) ,, ,, ,, ,, two minutes ; and
   (c) ,, ,, ,, ,, three minutes.
3. By shooting through the medulla, bleeding being performed :—
   (a) After an interval of one minute ;
   (b) ,, ,, ,, ,, two minutes ; and
   (c) ,, ,, ,, ,, three minutes.

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1 (a). Stunning by shooting perpendicularly through the cerebrum, bleeding being performed immediately afterwards.

A total of 330 were killed by this method which, when killing sheep by stunning, should be regarded as the correct one. In many cases the bleeding or sticking was followed by the common practice of breaking the neck and pithing. Although the latter procedure was quite unnecessary and of no

advantage, it did not appear to make any difference to the efficiency of bleeding or the appearance of the carcasses. The carcasses were examined immediately after being dressed and again after setting, and all were found well bled and in splendid condition. In eight cases hæmorrhagic spots were discovered as affecting the diaphragm, and in seven of these they were scarcely discernable owing to their minuteness, and could not be detected except by stretching the diaphragmatic muscular tissues and examining in an exceptionally good light. In the remaining one, the minute hæmorrhagic spots could be more easily detected, but even in this case they were not observed by the slaughterman. This was only natural, as there was nothing in the appearance of the diaphragm to attract attention by an ordinary survey of the carcass. The eight carcasses referred to, notwithstanding the description of the diaphragm given as a result of the minute and critical examination in each case, were all in beautiful condition.

	Number of Carcasses	Method of Stunning	Condition of Carcasses
(b)	6	Shooting into the cerebrum, directing the bolt towards the medulla and bleeding immediately.	Normal.
(c)	12	Shooting into the medulla and bleeding immediately.	Normal.
2.			
(a)	6	Shooting into the cerebrum and bleeding after an interval of one minute.	3 Normal. 1 Diaphragm presented hæmorrhagic spots, one being $\frac{1}{2}''$ long. 2 Diaphragm in each case presented two hæmorrhagic spots.
(b)	6	After an interval of two minutes.	3 Normal. 1 Diaphragm, one hæmorrhagic spot $\frac{1}{8}''$ long. 1 Diaphragm, three hæmorrhagic spots $\frac{1}{8}''$ long. 1 Diaphragm, seven hæmorrhagic spots, three being $\frac{1}{2}''$ in length.

XUM

	Number of Carcasses	Method of Stunning	Condition of Carcasses
(c)	6	After an interval of three minutes.	3 Normal. 1 Diaphragm presented fourteen hæmorrhagic areas, four being about size of a shilling and three about the size of a sixpenny piece. 1 Diaphragm presented eleven hæmorrhagic areas, four being as large as a threepenny piece. 1 Diaphragm heavily marked with hæmorrhagic areas varying in size from a threepenny piece to that of a shilling. Left peritoneum presented several hæmorrhagic oblong areas $\frac{3}{4}'' \times \frac{1}{4}''$; also several areas about $\frac{1}{8}''$ square. Right peritoneum, ten hæmorrhagic areas about $\frac{1}{8}''$ square and one measuring $\frac{3}{4}'' \times \frac{1}{8}''$. Left pleura, hæmorrhagic areas between the 3rd and 9th ribs, ranging in size from $\frac{3}{4}''$ to $1''$ long $\times \frac{1}{4}''$ wide. Right pleura, twelve hæmorrhagic areas, one $1'' \times \frac{1}{2}''$; one the size of a threepenny piece, and several $\frac{1}{8}'' \times 1/16$th inch square.
3.			
(a)	6	Shooting into the medulla, bleeding being performed after an interval of one minute.	3 Normal. 1 Three hæmorrhagic spots in diaphragm. 1 Four hæmorrhage spots in diaphragm. 1 One hæmorrhage in diaphragm more pronounced.
(b)	6	After an interval of two minutes.	Normal.
(c)	6	After an interval of three minutes.	3 No splashing but distinct evidence of imperfect bleeding.

	Number of Carcasses	Method of Stunning	Condition of Carcasses
(c)	6	After an interval of three minutes	1 Diaphragm slightly splashed with hæmorrhagic spots, one being ¼" long. 1 Kidney fat showed evidence of imperfect bleeding. 1 Diaphragm presented three hæmorrhagic spots.

It will be observed, according to the results of these experiments, that when sheep and lambs are bled immediately after stunning, the carcasses will be found well bled and in first class condition, whereas when intervals varying from one to three minutes are allowed to elapse after stunning before bleeding takes place, at least fifty per cent. of them may be found more or less extensively splashed ; and when the killing has been imperfectly performed by destruction of the medulla instead of the cerebrum, the splashing may be accompanied by more or less congestion or imperfect bleeding.

As distinguished from cattle and pig killing, the question of improper securing or the inability to stun with the first blow or shot does not arise so far as sheep and lambs are concerned for the reason that the traditional method of killing these animals is—like the Jewish method—one of bleeding only.

Ina number of cases the period elapsing between the commencement of sticking by the ordinary method of sheep killing and the cessation of consciousness has been timed and found to vary between 34 and 38 seconds, the differences in this respect apparently depending upon the more or less efficiency and quickness with which the operation is performed. By the Jewish method the operation of severing the blood vessels, etc., usually occupies less time than by the ordinary method, but when improperly performed one may find the time elapsing between the commencement of bleeding and the cessation of consciousness to be twice as great as that by the ordinary method properly performed.

Providing that in each case the operation is instantly and efficiently performed with extremely shape knives, there would appear to be little difference between the Jewish and ordinary methods of sheep killing.

Summary Conclusions.

1. The most humane method of slaughtering is that which renders the animal unconscious immediately.
2. The use of suitable mechanically-operated instruments is preferable to the pole-axe or hammer for the stunning of cattle and pigs.
3. Killing by injury of the medulla (pithing) which paralyses only,

XUM

before bleeding the animal, instead of stunning by direct concussion of the cerebrum, is an objectionable practice and should be prohibited.

4. The stunning of cattle and pigs with the ordinary felling hammer, mallet or pole-axe is not on a comparable basis with the ordinary or traditional method of sheep killing.
5. So far as efficient bleeding and appearance of the carcasses are concerned, it makes no difference whether the animal is stunned with a mechanically-operated instrument, mallet, felling hammer, or pole-axe.
6. When animals are properly bled immediately after stunning the carcasses are invariably found in perfect condition.
7. Undue delay in proceeding to bleed sheep or pigs after stunning may result in the carcasses being splashed, congested, or both.

TOWN HALL,
NEWCASTLE-UPON-TYNE.
30th March, 1929.

THE COUNCIL OF JUSTICE TO ANIMALS AND HUMANE SLAUGHTER ASSOCIATION.*

The Result of a Visit to Poland.

By Miss VIOLET WOOD, Secretary.

IN June, 1927, the Secretary of the Council of Justice went to Warsaw, having been invited by several Poles to visit that city and try to introduce humane killing into the Abattoir. As an account of that visit has already been written, it is unnecessary to repeat what occurred during that month. A Society was founded under the title of the Polish League of Friends to Animals, and as most of the working horses were unfit and suffering from sores, mange, lameness, blindness or with their hind legs dropping as they ran, it was decided that the most practical method of relieving their pain would be a Veterinary Dispensary. As no Society in Poland may receive money until it is legalized by the Government, which takes some time, the Council of Justice agreed to pay all expenses it would incur for three months, by which time the League hoped to be in a position to take the responsibility upon itself. This Polish League has not yet been in existence for two years, but has lately issued its Report for the year 1928, and the following is a brief account of its activities.

* *CHIEF OBJECT* :—To promote Humane Methods in the Slaughtering of Animals for Food, and the Painless Killing of Horses, Dogs, Cats and other Animals.

It asked the clergy to preach sermons on the subject of Justice to Animals, which they consented to do. During one year 1,952 letters were written, and 30,000 pamphlets distributed. Articles were published in various papers, and ambulances for injured horses placed upon the streets.

It bought 13 old and totally unfit horses that were working, and had them shot, and opened a branch at Zychlin, a town two hours' journey from Warsaw, with a membership of 100 persons. The number of patients received at the Dispensary during the year was as follows :— Horses 448, Dogs 1,992, Cats 236, other animals 98, making a total of 2,774.

The Inspectors of the League, with one exception, are unpaid, and the description of their work is given in the words of the League's Report.

Regional Inspectors.

The Council of Regional Inspectors was organized by the League in January, 1928. The duties of inspectors were set forth in specially printed " Instructions." Their main functions are : inspection of stables, slaughter-houses, market places and the like, also inspection of animals in the streets of Warsaw and the suburbs. Each inspector receives a sort of passport duly certified by the Police Authorities, and containing a note to the effect that policemen are bound to give the inspector every assistance possible in matters connected with the protection of animals. It was also understood that the inspectors are to have free access to all places and institutions where animals are being kept.

The activity of inspectors on the Warsaw territory is often very difficult and dangerous. There are many wild elements here after the War, and especially the class of professional drivers is known by its cruelty and barbarian instincts. It was essential, therefore, to provide the inspectors with Brownings and Police whistles.

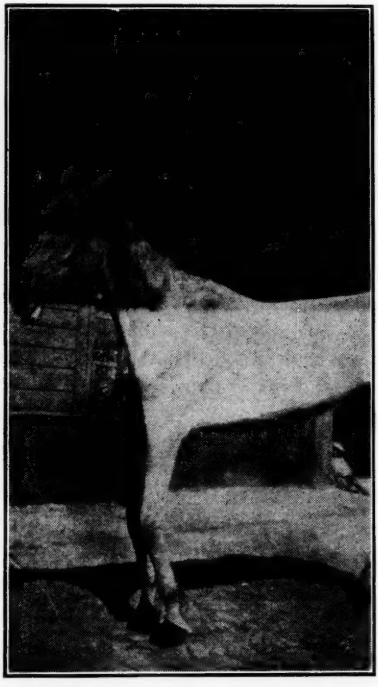
The city of Warsaw is divided into 27 police districts, and each inspector was assigned one of these districts as his particular field of operation. Within a few days after his appointment the inspector had to call on the chief of the police in his district, the so-called " Commissar," from whom he obtained a list of stables and addresses of cabmen and drivers. Close co-operation is established between the Commissar and the Inspector. The latter can always have a few policemen at his disposal to accompany him to particular places.

The inspectors received printed forms of protocols to be directed to the court or to police authorities in all cases where cruelty to animals was noted. These forms were prepared as per pattern furnished by the local authorities, and the protocols are given careful and prompt

XUM

attention. In order to illustrate the activity of inspectors we are quoting below a few cases, each of which should be handled in a different way, for example :—

A lame or wounded horse is noticed in the street :—The inspector has to stop the cart and to direct the horse to the nearest police station to have it "sealed." (A string is put round the horse's neck the ends of which are passed through a piece of cardboard and fixed by a seal so as to be sure that the animal will not be used for work until the owner produces a doctor's certificate that the animal is fit. The seal is then taken off by the police.)



One of the 13 Horses rescued from working in misery by the Polish League.

If the horse is not seriously injured :—The inspector should direct the animal to our dispensary. He produces a small book from his pocket containing blank forms with the dispensary address, and fills in the name of the driver, description of the horse and other details. This sheet is given next to the driver who is instructed to take the horse to the dispensary. The driver's address is noted separately by the inspector for sake of control.

If a horse is overloaded :—The inspector stops the cart and draws a protocol to be directed to the police authorities. He then orders the driver to stop in the street and secure another horse, or else directs the cart to the nearest police station where part of the load is discharged. The owner of the horse will be fined for overloading the animal.

If the driver is cruelly beating a horse :—The inspector stops him, secures the driver's name and address, and directs a protocol to the court where the guilty will be punished.

XUM

In all other cases of cruelty to animals :—Protocols are directed to the court.

Statistics for 1928 show the results of our inspectors' activity as follows :—

Sealed (horses)	156	Directed to dispensary (horses)	390
Protocols drawn	361	Stables inspected ..	657
Court decisions passed ..	85	Animals inspected ..	2,819

In addition to the above, inspections were made at the slaughter-house, the circus, in market places, etc., and reports on such inspections were published in the Warsaw Press.

The Council of Justice to Animals is sending out this brief account of the magnificent work of the Polish League in the hope that it may be an encouragement to other struggling Societies, and that the excellent idea of " sealing " horses may be adopted in this country as well as in all others.

They trust, too, that it may lead many to join their Foreign Legion and make the work they helped to start in Poland possible, not only in all towns of Europe where it is necessary, but in all countries of the world.

HIGH PROTEIN DIET AND RENAL DISTURBANCE IN YOUNG SHEEP.

By JAMES STEWART, M.A., B.Sc., Ph.D.

Department of Animal Pathology, Cambridge University.

Of late years in the eastern counties of England there has been repeatedly observed a disease amongst young lambs which, on account of one of its principal features, has been called, for want of a better name, " Pulpy Kidney Disease."

Lambs which have shown no previous symptoms, die suddenly. On *post-mortem* examination the principal, and usually only, pathological feature is a peculiar disorganisation of the substance of one or both kidneys which has become resolved into a pulpy mass. Lambs which seem to be most susceptible to this condition are usually about twelve to fifteen weeks of age, at which time in many instances they have been placed on an artificial food ration or at least had their natural pasture supplemented by artificial food in the form of concentrates such as linseed cake and cottonseed cake. An interesting feature is that lambs usually affected appear to be those in the best condition and most forward for their age. On *post-mortem* examination of the carcasses of lambs which die of this disease, there

XUM

is usually no evidence that the condition is of bacterial origin. In a number of examinations carried out by the Department of Animal Pathology, Cambridge, it has not been found possible so far to isolate any organism which was capable of reproducing the disease, but further work on this problem is still being carried on. From the nature of the ration fed to most of the sheep which succumb, and from the forward condition of the animals, it has come to be generally accepted that the disease is in all likelihood due to an excessive protein consumption. This view is supported by the observation that when the artificial ration is discontinued the deaths stop immediately. Professor T. B. Wood (1) in discussing the feeding of sheep, says, " There is an almost universal tendency amongst farmers to overdo the protein in the ration of fattening animals, especially sheep. It may well be that this excessive consumption of protein is the cause of many of the sudden deaths amongst sheep folded on roots in the winter. The extra work thrown on the kidneys by excessive protein consumption may cause a serious derangement which results in sudden death."

The disease is not confined to England, as is shown by some recent publications in various journals of the Agricultural Colleges of the Dominions. Gill (2) described an almost identical disease in New Zealand but in slightly younger lambs. He says " For many years throughout New Zealand, where the fat lamb industry is carried on, sudden deaths have occurred amongst lambs at the age of three or four weeks. *Post-mortem* examination of the carcasses has shown a pulpy condition of the kidneys, and an excessive amount of fluid of the heart sac. The lambs which died were always exceptionally forward for their age, and after much careful work it was concluded that the trouble was of dietetic origin." Dakin (3) reporting on a disease known as " Beverley Disease " in Western Australia describes it as follows, " Unconsciousness and quiet death. Carcass is invariably that of well nourished lamb. *Post-mortem* appearance mainly negative as far as pathological degeneration of the organs except for marked lesions in the kidneys which are quite soft and sometimes almost fluid." Though he himself believes that the disease is of bacterial origin associating it with Braxy, he concludes thus, " No organism could be discovered which could be regarded as the cause of the disease and the condition of the feed and the treatment of the sheep in regard to the feed seemed to be associated factors of great importance."

Two typical cases of this disease were sent to the Department of Animal Pathology, Cambridge, for diagnosis during the late Spring of 1928, and are described below together with an account of the ration which had been fed to the sheep.

XUM

Case 1.

A farmer, near Cambridge, in May, 1928, lost twenty twelve-week-old lambs within seven days, all of which died suddenly. They appeared to be well and looking normal at night, but were found dead in the morning. One of the animals sent for examination showed as the only pathological change a typical pulpy kidney which, as far as could be determined, was quite sterile. The sheep had been folded on sainfoin and were receiving $\frac{3}{4}$ lb. daily per head, of a mixture of equal parts of crushed beans, flaked maize and linseed cake. Of course, it was more than probable that several of the lambs received more than their share of the feed. It had been observed in former cases that it was usually those animals, which might be called the bullies of the flock, in that they liked to take the most, and drove the other animals away from the feeding troughs till they themselves were satisfied, which were the first to succumb.

Case 2.

A lamb from Cambridge University Farm which had been on a feeding experiment appeared well on the previous evening but died during the night. On *post-mortem* examination, it was found to have a pulpy kidney, this being the best specimen of a pulpy kidney that has been obtained. The ration consisted of 3 parts linseed cake, 1 part peas, 1 part oats, 1 part Kositos (flaked maize), one half to three quarters of a pound being fed to each lamb. Though a large number were being fed on this ration only the one animal died.

The following are the microscopical findings on a section of the kidney in Case 2. The cortex showed a uniform necrosis affecting both the glomeruli and the collecting tubules. In some areas the general outline of these structures could still be observed, but in others the cells had been entirely broken down, leaving an undifferentiated tissue. The necrosis extended as far as the boundary layer. In the medulla there was well marked congestion of the vessels. Here, many of the tubular cells were apparently normal in appearance, or showed but slight evidence of degeneration. Some, however, were markedly abnormal, showing all graduations from slightly swollen appearance to vacuolisation of the cytoplasm, accompanied by loss of the cell wall even to complete necrosis.

It has been suggested by Owen-Johnston (4) that " pulpy kidney disease " is due to oxalate poisoning. The evidence is, however, of a very unconvincing nature, and the fact that attempts made to set up a similar condition by dosing sheep with oxalate were more or less successful in that a necrosis of some of the cells of the tubules was demonstrated histologically in the experimental animals, must not

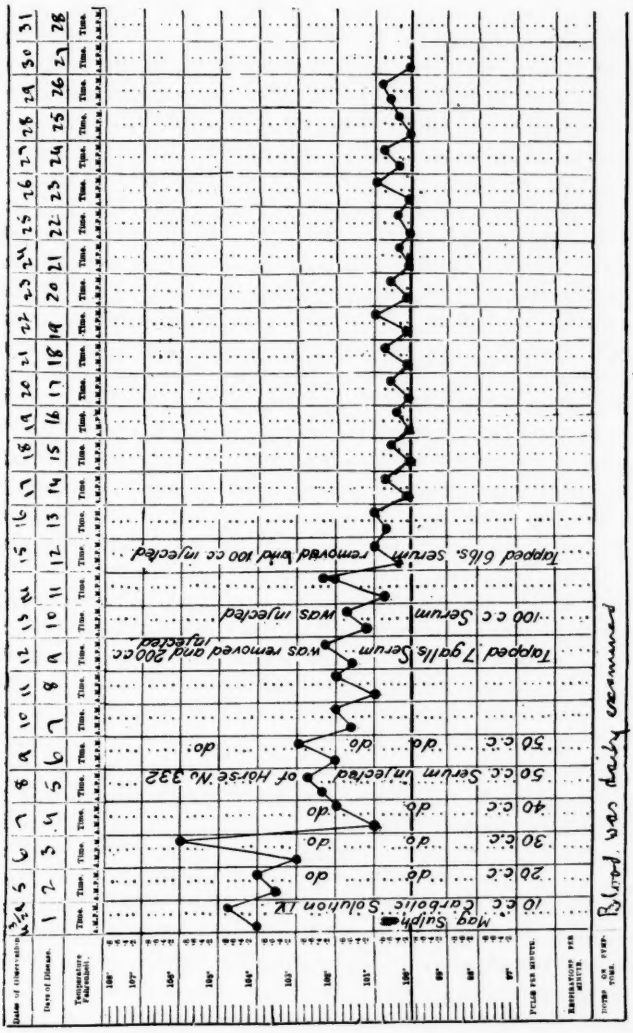
XUM

be regarded too seriously since there is no evidence to support the hypothesis that oxalate could be obtained in sufficiently large quantities under natural conditions. Certainly in this country at least, oxalate cannot be regarded as the cause of the disease, since sorrel, the principal source of oxalate in pasture, has never been observed in the grassland or folds of sheep which have died of pulpy kidney. In considering the rations fed to the animals in Cases 1 and 2 cited, it will be observed that a common feature of the ration is the high protein content, and this encourages the belief that the cause of the disease might be excessive protein consumption.

During recent years numerous investigations have been pursued especially in America with a view to determining the effect of diets containing a high proportion of protein upon the structure and functioning of the kidneys. Although it is generally acknowledged that the ingestion of excessive amounts of protein is harmful in the case of pre-existing disease, there is considerable difference of opinion regarding the part played by such diets in the causation of disease.

Newburgh (5) using rabbits fed upon a diet consisting of a mixture of egg-white, casein, and soya bean, observed pathological changes in the kidneys which he described as a congestion. He states that definite lesions of the tubules were also present. Employing a diet consisting of egg-white alone, he produced a nephritis in a very short space of time. With a diet containing 87% casein, the renal lesions were produced in a remarkably short time and were of a very definite character. When, however, the casein was reduced to less than 33% of the total diet, no changes were found. In a later communication Newburgh and Clarkson (6) state that by giving a ration consisting of lean dried meat and some green food they again produced a nephritis accompanied by arterio sclerotic changes. An interesting feature of this work, in view of the results obtained by the writer in the experiments about to be described, was the change produced in the reaction of the urine of the rabbits under experiment. While the urine of some gave an acid reaction, that of others was alkaline. It was found, however, that the reaction of the urine had no effect upon the existence of the nephritis since renal lesions were observed in both cases. The general conclusion of the writers was " That an acid urine *per se* did not produce nephritis in the rabbit, but that it might lead to some albuminuria." Frandsen (7) studying the effects produced by inorganic salts and nitrogen on renal lesions in rabbits induced by potassium bichromate found that the animals became uraemic when fed on a diet which was very rich in nitrogen. Polvogt, McCollum and Simmonds (8) feeding rats on a diet containing 31% to 45% protein for periods of from 100-480 days, found that during these periods the normal rate of

growth was maintained, but that after a time the rats developed a chronic nephritis. Pathological and clinical evidence produced to



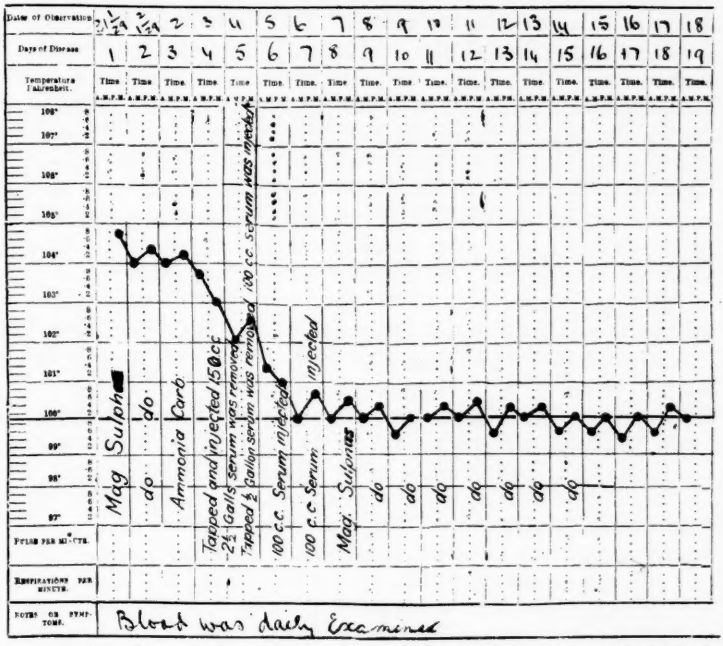
support this condition was, however, comparatively meagre, and the results are not in agreement with those of other workers who used rats as their experimental animals. Jackson and Riggs (9) found that

XUM

they were unable to produce any recognisable nephritis by feeding rats on diets containing a very high proportion of protein over a period of from 10—20 months (more than one third of the animal's lifetime). They recorded, however, a slight hypertrophy of the kidneys and also an albuminuria during the period of the experiments. Osborne and Mendel (10) fed rats on a diet containing 87.5% protein. They observed a diuresis during the period of the experiment, and on *post-mortem* examination found only an hypertrophy of the kidneys. The average weight of these organs was almost twice that of the kidneys of the control animals, and their size was about one third greater. Microscopical examination failed to disclose any changes of an inflammatory or degenerative nature. In discussing this observation they say " In this respect our findings seem to be at variance with those recently reported by Polvogt, McCollum and Simmonds, who have described serious lesions of the kidneys of rats subsisting on diets which, though termed 'excessive' in protein, contained a considerably lower content than the rations in our present experiment." In a later paper Osborne, Mendel, Park and Winternitz (11) confirmed their previous work, and came to the conclusion that hypertrophy of the kidneys is a characteristic feature in animals fed on a diet in which the proportion of protein exceeds about one third of the ration. In discussing the histology of the specimens they came to the conclusion that the changes were physiological and not pathological, since only two of their experimental rats showed renal lesions, while three of the control animals were similarly affected. They also observed a slight albuminuria both in the experimental and in the control animals, and came to the conclusion that albuminuria is quite a normal characteristic of rats. Reader and Drummond (12) confirmed Osborne and Mendel's work, finding that there was no renal damage, though a definite hypertrophy of the kidneys was present in rats fed on a diet consisting of 50% to 90% cod liver oil, yeast, and lemon juice. Maclean, Smith and Urquhart (13) using rabbits as experimental animals found that there was no evidence that a high protein diet had any deleterious effect on the kidneys of that animal. They observed, however, that if green food is withheld from the diet, nephritis results, no matter what the protein content of the ration may be. Addis, MacKay and MacKay (14), working with rats, found that feeding them on a high protein diet produced no deleterious structural effects on the kidneys.

From the foregoing experiments it appears to be evident that whilst diets containing a high proportion of protein appear to produce definite pathological changes in the kidneys of rabbits, such changes are not observed in rats under similar conditions. In seeking some explanation of this difference it should be remembered that the animals

belong to two widely different classes, and it may well be that the rabbit unaccustomed to such high protein rations is more liable to be adversely affected than is the rat, which from its natural proclivities is more accustomed to the ingestion of foods containing a considerable proportion of protein. The results obtained by these workers, therefore, tend to show that herbivorous animals such as sheep would appear to be liable to adverse effects from high protein diets, and in studying the aetiology of "pulpy kidney disease," the following experiments



were therefore designed in order to determine what pathological changes, if any, were produced in the organs of the sheep under these conditions.

Method of Conducting the Experiments.

The experiments were divided into two groups. In the first, young lambs were fed on high protein diets and changes in their metabolism were recorded by means of nitrogen balances, and in some cases by growth curves. The second group consisted of a number of feeding experiments in which batches of young lambs were kept in the open field, the food being regulated and the effects of high protein feeding on such animals living under practically normal conditions were noted as accurately as possible.

XUM

Metabolic Experiments.

The lambs were placed in metabolism cages similar to those described by Wood and Woodman (15) in their digestibility trials, and a harness of the Halnan type was used. The metabolism cages were of the Lehmann model modified in order to render them suitable for the harness used in the experiment. The harness consisted essentially of a rubber canvas sheet fixed by suitable body straps and belts to the hindquarters of the sheep. The lower end of the sheet was weighted and could hang freely over the end of the floor of the cage, the weight keeping the sheet taut whether the sheep was in a standing or recumbent position. The solid excreta were thus directed into a receptacle at the rear of the cage. The floor was perforated with small holes and two parallel metal guides were fixed to the under part of the two sides of this portion. These were so inclined as to run to the centre where a small funnel shaped device led into the neck of a suitable container. In this way the urine was drained through the holes of the perforated portion of the cage floor and was caught in the container. By these means the fæces and the urine could be collected separately.

The cages were of such a size and design as to allow the sheep perfect freedom of movement in lying down and standing up. The food and water troughs attached to the cage were shaped so that while the animal had free access to them, it was unable to scatter much of the food over the floor whilst eating. All animals were allowed some time to get accustomed to the cage and to their new ration before records were kept, or the experiment proper was considered to have started.

The food of the ration was weighed out each morning from the bulk and, in the case of grass, the composition of which was varying daily, the methods described by Woodman, Blunt and Stewart (16) in their pasture digestibility work, were employed. The dry matter was estimated daily, and a composite three-day sample of the grass was analysed every three days.

Each morning, the amount of fæces was weighed and the volume of urine measured. An amount corresponding to one fifth of the daily fæces and one tenth of the daily urine was kept in cold storage and a composite sample made up every three days, which was then analysed. The food, as stated, was weighed out every morning and the residue which was gathered every three days was measured and analysed. In this way a very accurate three-day nitrogen balance was maintained, so that a careful record of the protein metabolism (as far as balance work can show) was made. In addition a daily sample of urine was obtained and examined for the presence of albumin, sugar, and other abnormal constituents, in order that any indication of gross changes in the kidneys might be immediately recognised. The procedure

XUM

adopted to ensure an increasing protein content was as follows: The ration usually consisted of concentrates, hay and mangolds, and as the experiment proceeded, the chief concentrate was increased at the expense of the hay or the mangolds. In the first experiment the ration consisted of cottonseed cake, barley meal, hay and mangolds. As the experiment proceeded, the barley meal and hay were gradually reduced, whilst the cottonseed cake was increased in like amount. The quantity of protein consumed was thus increased gradually. In the first two experiments the sheep started with a very low protein intake which was steadily increased. In the other three experiments the protein intake was very high, even at the commencement, and was increased still further. This was designed to demonstrate if a sudden change to a high protein diet would produce a greater effect than the more gradual change. In order that the sheep should not get unduly wearied by cage conditions, they were allowed periodic rests of three days at convenient intervals in a large pen, but were fed on the same ration as was given during the experimental period.

Table I.

Table showing period of experiment, initial and maximum amount of protein ingested, age and weight of sheep.

No. of Sheep.	Age at Start.	Initial daily amount of protein intake.	Maximum daily amount of protein intake.
Sheep I	10 months	64 grams	186 grams
Sheep II	10 ,,	139 ,,	142 ,,
Sheep III	4 ,,	171 ,,	395 ,,
Sheep IV	5 ,,	130 ,,	360 ,,
Sheep V	15 weeks	243 ,,	290 ,,
Sheep VI	7 ,,	140 ,,	400 ,,

No. of Sheep.	Initial Weight.	Final Weight.	Period of Experiments.
Sheep I	Not weighed.	Not weighed.	11 weeks.
Sheep II	Not weighed.	Not weighed.	8 ,,
Sheep III	8 stone 10 lbs.	9 stone 2½ lbs.	17 ,,
Sheep IV	8 ,,	10 ,, 8 ,,	34 ,,
Sheep V	6 ,, 7 ,,	6 ,, 9 ,,	13 ,,
Sheep VI	3 ,, 2 ,,	3 ,, 5 ,,	9 ,,

XUM

It will be observed from Table I that there was considerable variation both in the age and weight of the sheep and in the maximum amount of protein consumed. Even the lowest maximum amount of protein employed (142 gms.) is, however, considerably in excess of the amount usually consumed by a 10 months old lamb, i.e. 70 to 80 gms. of protein per day. When it is taken into account that amounts as great as 390 and 360 gms. of protein were consumed by Sheep III and Sheep IV, which is well over four times the normal quantity, and that in the case of Sheep VI which weighed only 3 stone 5 lbs., the daily intake of protein was 400 gms., it is interesting to observe the singular uniformity of the results as shown by the account of the macroscopical and microscopical findings given below. The diets employed were all of a usual nature as regards their composition except in the case of Sheep VI, which, in order to increase its protein consumption to an excessive extent, was given pure casein in addition to its usual ration. The diets of Sheep I and Sheep II were composed of mangolds, hay, barley meal and decorticated cottonseed cake ; the barley meal being gradually eliminated and extra cottonseed cake substituted. The diet of Sheep III and IV consisted of pasture grass, barley meal and linseed cake. In the case of Sheep III and IV both the pasture grass and the barley meal were gradually eliminated until the ration consisted entirely of linseed cake, and on this extraordinary ration Sheep III existed for one month and Sheep IV for over six months. Sheep V had a ration composed of chaff, sugar beet pulp and linseed cake, which after two months was changed to one of entirely linseed cake, which Sheep V ate avidly for over one month. The ration of Sheep VI as already stated, was of a more unusual order, 300 gms. of casein being added daily to a feed consisting of chaff, oats and sugar beet pulp.

The daily clinical examination of the urine of the experimental animals showed little abnormality. Sheep II developed an hæmoglobinuria accompanied by albuminuria, and was therefore killed. In the case of Sheep IV sugar was found in the urine on two occasions during a period of nine months. On each occasion the presence of sugar coincided with a large output of albumin. The most interesting feature of the clinical analysis of the urine was found to be a periodic albuminuria. This occurred in the case of all the sheep under experiment and could not be correlated with any fluctuation in either protein consumption or excretion. The writer has since shown (17) that albumin is a normal constituent of sheep's urine.

Since the clinical analysis of the urine showed no great abnormality the animals were killed at stated intervals, and a thorough *post-mortem* examination made. The results of the *post-mortem* examinations and of the microscopical findings are detailed below.

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Post-Mortem Examination of Sheep on High Protein Diet.

Macroscopic examination of the organs of the sheep showed little or no evidence of disease. In the case of Sheep I and Sheep II which had been under experiment the shortest period of time, namely, eleven and eight weeks respectively, the liver appeared to be slightly firmer and paler than normal. Lobulation was also a little more pronounced. There was no evidence of any fatty change or any degree of fibrosis. The boundary layer of the kidneys was slightly congested. On *microscopical* examination the livers of Sheep I and Sheep II showed traces of cirrhosis and the liver cells themselves appeared to be slightly damaged—their protoplasm straining rather less deeply than normal. The kidneys, however, showed very little alteration. The glomerular tufts appeared to be quite normal, but the epithelium of the convoluted tubules showed evidence of early degeneration. The outlines of the individual cells appeared indistinct, and their protoplasm was less dense and more granular than usual. The nuclei, however, stained quite well.

Sheep IV and Sheep V showed even less change than the above. The liver appeared quite normal, and the kidneys on *macroscopic* examination showed no evidence of any inflammatory or degenerative change On *microscopical* examination the same change was observed in the epithelium of convoluted tubules as mentioned in the case of Sheep I and Sheep II, but no other deviation from the normal could be seen.

Sheep III was the only animal in which marked variations from the normal could be observed and the change was only evident on *microscopical* examination. Changes were observed both in the parenchymatous and interstitial tissues. There was a marked congestion of the blood vessels throughout the organ. In the cortex the blood had undergone a change. In places individual corpuscles could no longer be seen, the blood appearing homogeneous as though it had become hæmolysed. In the cortex the glomeruli showed a marked congestion and the presence of young fibroblast cells. Bowman's capsule was much thickened and fibrous. The cells of the collecting tubules showed the greatest change, there being an actual necrosis of the nuclei. In others, in which the degeneration was not so advanced, the cells were swollen, the cytoplasm was highly granular and the outline of the cells very indistinct. In most of the tubules a fine network could be seen passing across the lumen from cell to cell accompanied by evidence of proliferation of these cells. In addition to the congestion numerous young fibroblasts could be seen between the tubules in both the cortex and the medulla.

In the case of Sheep VI, which had the casein diet, i.e. that with the highest percentage of protein, the kidneys showed the least change

XUM

of all those in this series, only the slight alteration in the epithelium of the convoluted tubules previously noted being evident.

The livers of Sheep III, IV, V and VI showed no sign of any pathological lesion of a gross nature. The nuclei stained well and the cells showed the usual variation in staining intensity. The sinusoids were evident and did not contain much blood and the Kupffer cells showed the usual intense staining reaction with haemotoxylin.

The other organs were quite normal in all the sheep examined.

Description of Feeding Experiments on Batches of Lambs on High Protein Diets under Normal Conditions.

As a corroboration of the experiments carried out on sheep under the unnatural conditions of the metabolism cage, it was considered advisable for the purpose of comparison to feed a number of lambs on a high protein ration and permit them to eat and digest it under natural conditions. During the Spring and Summer of 1928, young lambs were fed for varying periods on different rations, each with a high protein content. It was desired that, when these lambs were put on experiment, they should be of an age at which they have most difficulty in dealing with a sudden increase in protein in their diet. The age regarded as most suitable for this purpose was from 8 to 10 weeks, since by that time they would not have long been off their mother's milk, and would be unaccustomed to a diet consisting largely of concentrated food. Consequently some adjustment would have to be made to deal with this new diet. Since the ingestion of considerable quantities of protein entails extra work for the kidneys, it was thought that these young lambs would be more likely to exhibit disorders of those organs than would older animals which had already been educated to such dietetic conditions.

The lambs were divided into batches of four or six, according to the number available for use at the time. Each batch was penned in a field of young pasture grass so that in addition to the ration weighed out for them in their feeding troughs, they had an extra supply of protein from the grass itself which, at that period of the year, has a very high protein content (16). At intervals during the experiment samples of urine were obtained from the lambs and analysed clinically. The lambs were usually left on experiment for two or three months. It was thought that if no sign of renal or other organic trouble had manifested itself by that time, it would probably never do so.

Details of the High Protein Feeding Experiments.

Experiment 1.

Four lambs, aged 9 or 10 weeks, were placed on experiment in the middle of February on a diet consisting of linseed cake, oats, and chaff.

The average daily ration of each lamb at the start of the experiment was 1½ lbs. of linseed cake, ¼ lb. oats, ¼ lb. of chaff, which has a protein content of approximately 198 gms. Since all the feed was in one trough it was more than probable that it was not equally distributed, and that one lamb received more than its share whilst another had to do with less. This difficulty in accurately gauging the amount eaten by each lamb is present in all the feeding experiments described in this series, but the conditions are the same as those under which normal lambs are fed and among which pathological changes do occur in the kidneys. The young lambs in this first experiment ate their feed readily and by the end of the first fortnight the consumption of linseed cake had increased to 3 lbs. per head per diem, or about 340 gms. of protein. This was continued for a period of eight weeks. During this period the lambs appeared to make normal progress and to be fine, healthy, animals. At intervals during the experiment a chemical analysis was made of samples of urine obtained from each of the lambs. In all cases a slight albuminuria was present and the urine was found to give an alkaline reaction. With this exception it appeared normal, and there was no indication of abnormal functioning of the kidneys.

Experiment 2.

Five lambs aged about eleven weeks were put on experiment on the 8th May. Their ration consisted of crushed beans, flaked maize and linseed cake. At the commencement of the experiment the ration consisted of equal parts of these three constituents, and 1 lb. of the mixture was allowed to each lamb, the average daily consumption of protein being approximately 83 gms. The linseed cake was gradually increased until each lamb received 2 lb. of linseed cake, 1/3 lb. crushed beans and 1/3 lb. flaked maize, having a protein content of 286 gms. This proved to be the maximum amount of the ration which these lambs would consume. Attempts were made to render the diet more tempting by the addition of sugar beet pulp, but this failed, and the lambs therefore received the above diet for eight weeks. During this period they gained in weight and appeared to thrive. Samples of urine were taken at frequent intervals and as in the case of Experiment 1, a trace of albumin was always present. Since there was no further clinical evidence of disorder of the kidneys the lambs were taken off experiment on July 22nd having been nearly three months on the high protein diet.

The ration fed to this batch of lambs is exactly that which was supposed to give rise to the condition of " pulpy kidney " noted in Case 1 (see page 3). It will be noted that the protein content was increased to 400% above that which was supposed to produce the disease and as will be seen no apparent ill-effects could be traced.

XUM

Experiment 3.

Six lambs, ten weeks of age, were put on experiment on 7th June. The diet, which consisted of linseed cake, oats and chaff, was similar to that fed in Experiment 1. The initial ration was composed of ½ lb. of linseed cake, ¼ lb. of oats, and ¼ lb. of chaff, having a protein content of 75 gms. By successive increases in the quantity of linseed cake the amount of protein consumed was ultimately 256 gms. Quantities in excess of this were refused and the ration was therefore maintained at this level during the rest of the experiment. As in the case of the other batches, examination of the urine revealed nothing more than a slight albuminuria, and as there was no evidence that the ration was producing any harmful effects in any of the lambs the experiment was terminated after eleven weeks.

Experiment 4.

Three lambs of about eight weeks were put on a ration of ¼ lb. of linseed cake, ¼ lb. of oats, and ¼ lb. of chaff, the average protein content being 42 gms. By this time the grass of their pen was of a very luxuriant nature, and it was with difficulty that the lambs could be persuaded to consume the artificial foods provided for them in the troughs. However, the ration was increased to 1½ lbs. of linseed cake, ¼ lb. of oats, and ¼ lb. of chaff, the protein content of which was 186 gms. A conservative estimate placed the amount of grass consumed by each lamb at 1,000 gms. daily, which added another seventy-five to one hundred grams of protein to their daily ration, making a total of approximately 260 gms.

The lambs of this group were slightly younger than were those in the preceding experiments and probably ate more of the easily digested food, the pasture grass. Further, although they did not consume so much of the artificial food, their rate of growth appeared to be more rapid than that of the lambs in the other batches. These lambs were continued on experiment over twelve weeks, and even at the end of that time they did not take more of the ration supplied to them in their feeding troughs, but they ate the grass of their pen so quickly that it had to be repeatedly moved to different parts of the field. This batch showed a more marked albuminuria, but no harmful effects could be observed, the animals thriving and showing quite a considerable gain in weight.

Experiment 5.

Six unweaned lambs were penned in such a manner as to allow them free access to the ewe, whilst the ewes could not reach the ration provided for the lambs. This was accomplished by allowing sufficient space between some of the hurdles composing the pen for a lamb to

pass through but insufficient for an adult sheep. In order to make sure that they would suck their mothers, the lambs were allowed to run with the ewes twice a day, and were then repenned. From the disappearance of the ration in the troughs and observation of the ewes, it was found that the plan worked satisfactorily, since the lambs took both the artificial food and their mother's milk, and probably some of the young grass in their pen. With such young lambs it was difficult to give a really high ration to start with, and an initial feed of 1 lb. flaked maize, 1 lb. of crushed beans, and ½ lb. of linseed cake was divided amongst them which provided each lamb with about 35 gms. protein plus the amount in their mother's milk. The artificial ration was gradually increased till the six received 3 lbs. of flaked maize, 3 lbs. of crushed beans, and 3 lbs. of linseed cake, which would give each a daily protein allowance of about 140 gms. By this time they had ceased having the ewe's milk, but to compensate for this the grass of the pen had reached the stage when the protein content would be very high, and taking this into account, they were probably consuming well over 200 gms. protein per diem. The amount of artificial food could not be increased, but they maintained the high level till the end of the experiment, which lasted twelve weeks.

Clinical examination of the urine of these younger lambs showed, as in those in Experiment 4, a somewhat higher albuminuria than that in the other batches, but no trace of casts or other signs of kidney disruption could be found. It would appear, therefore, that even those very young lambs could eventually become accustomed to a high protein ration without any serious clinical effects being produced.

The result of this last experiment is of considerable interest, since New Zealand workers (2) engaged on research into the aetiology of " pulpy kidney " disease have suggested that a possible cause of the deterioration of the kidneys of young lambs might be due to the protein of ewe's milk.

Discussion of Results.

In discussing the results of this series of experiments, it must be observed that in one respect they cannot be compared with those obtained by Osborne and Mendel (10) in rats or Newburgh (5) in rabbits. The primary object of the experiments was to obtain information which would be of some practical value, in elucidating the cause of " Pulpy Kidney Disease in Sheep." For this reason the diets which were employed with the possible exception of that fed to Sheep VI, were of quite a usual nature in respect of their composition, and not of an unnatural character such as a diet consisting of 85% or 90% of casein. Under these conditions it was not possible to employ a diet containing a proportion of protein of the same order as that used by

XUM

Osborne and Mendel. The term " excessive protein diet " used in this paper is intended to imply that the amount of protein which was fed was very much in excess (400–600%) of that contained in the normal ration of sheep. The diets fed to the lambs in the feeding experiments in the field were all based on diets which had been alleged to cause deterioration of the kidneys in lambs. When we consider that the protein content had been increased by 600% and that the lambs were all of that age when they would have most difficulty in dealing with an excessive protein diet it is interesting to observe the singular uniformity of the results.

The account of the macroscopical and microscopical findings given with the exception of that of Sheep III, shows definitely that no gross lesions were produced by feeding for a considerable period of time on diets containing an abnormally high amount of protein. The slight variation from the normal observed on microscopical examination of the kidneys of all the sheep except Sheep III, namely a slight change in the epithelium of the convoluted tubules which cannot be regarded as of pathological importance, must not be considered *per se* a disorder of such a nature as to impair the functions of these organs. The rather more serious changes in Sheep III, namely the slight congestion of the blood vessels, the more marked congestion of the glomeruli and the necrosis of the nuclei of the cells of the collecting tubules is worthy of consideration. The clinical examination of the urine of Sheep III did not show any material difference from that of the other sheep, sugar was absent, casts were not found and the albuminuria was no more marked in this than in the other animals. Sheep III and Sheep IV, up to the point of Sheep III's death, showed identical metabolism of the protein of their ration. Sheep IV, however, was kept on experiment for a further four months on the same ration and, as is seen, showed only very slight changes in the kidneys. It is doubtful, therefore, if the more profound changes seen in the kidneys of Sheep III can be ascribed to the results of high protein feeding, especially having regard to the results obtained in the rest of the animals on experiment. As has been pointed out, the kidneys of lambs are reduced to pulp in the short space of a few days by some cause which is alleged to be of dietetic origin, and has been regarded by several observers as due to excessive amount of protein in the ration. If extensive disruption of the kidney tissues can be brought about as rapidly as is observed in cases of " Pulpy Kidney Disease " as a result of feeding on diets abnormally rich in protein it would be reasonable to suppose that some gross pathological changes would have been produced in the kidneys of the sheep employed in these experiments. These experiments show, however, that the kidneys accommodate

themselves with remarkable rapidity to the extra work thrown upon them by enormous increases in the protein of the diet.

That the extra protein was digested and not just excreted as waste material via the fæces is illustrated by Table II, which shows that, as the protein consumption of Sheep III and IV increased, the output of nitrogen by the urine increased also while that by way of the fæces remained remarkably constant throughout.

Table II.

Sheep IV.			Sheep IV.			Sheep III.		
Comp. No.	Fæces.	Urine.	Comp. No.	Fæces.	Urine.	Comp. No.	Fæces.	Urine.
	gms.	gms.		gms.	gms.		gms.	gms.
1	8·36	18·71	26	6·86	37·46	1	6·4	13·04
2	7·63	20·42	27	7·44	38·82	2	10·39	16·97
3	7·97	20·08	28	8·51	41·71	3	9·35	15·23
4	8·70	24·65	29	9·54	47·47	4	8·97	13·24
5	9·50	28·12	30	10·87	49·33	5	8·95	18·15
6	11·36	25·50	31	10·80	46·69	6	11·30	17·96
7	11·26	30·02	32	8·91	44·51	7	9·38	26·10
8	11·48	32·88	33	8·78	40·57	8	9·51	26·70
9	21·96	38·08	34	10·65	37·16	9	8·74	26·33
10	12·81	41·01	35	10·62	38·29	10	9·57	30·99
11	14·85	45·83	36	9·42	36·50	11	11·62	38·85
12	13·77	47·74	37	9·80	31·84	12	10·35	38·85
13	11·55	38·44	38	9·34	39·97	13	11·98	42·47
14	13·51	52·44	39	9·84	39·71	14	11·47	43·22
15	11·25	40·03	40	8·68	37·30	15	12·32	47·32
16	13·02	54·23	41	9·15	37·56	16	11·56	40·77
17	11·25	47·00	42	7·45	44·41	17	13·42	48·48
18	13·02	38·17	43	9·96	39·16	18	10·76	44·96
19	10·00	35·74	44	8·55	43·63	19	8·40	42·93
20	8·49	38·29	45	6·76	40·53	20	7·86	38·69
21	8·49	35·74	46	4·49	22·50	21	8·97	36·21
22	7·27	38·29	47	2·45	16·54	22	8·44	31·92
23	7·64	33·84	48	1·93	25·20	23	7·96	39·24
24	8·08	34·54	49	4·34	28·82	24	8·94	34·70
25	7·86	38·33	50	4·84	27·66			

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Conclusion.

The results of these experiments do not support the findings of Newburgh (5) that a high protein diet is injurious to the kidneys.

Even the slight physiological change attributed by Osborne and Mendel (10) to high protein feeding, namely the hypertrophy of the kidneys which they invariably found on *post-mortem* examination of the rats kept on high protein diet, could not be confirmed in the case of sheep.

In the experiments described there was no evidence that excessive amounts of protein in the diet of sheep were productive of any definite disorganisation of the kidneys of those animals (with the single exception of Sheep III, in which the lesions may, or may not, have been due to the high protein feeding). An hypertrophy, if produced, was of so slight a nature as to be incapable of being detected.

Taking these conclusions into consideration, therefore, it must be agreed that high protein diets are not in any way responsible for that condition in sheep known as " Pulpy Kidney Disease." In endeavouring to arrive at the probable cause of the disease, many baffling features present themselves, but in the judgment of the writer based upon the results of the present experiments *excess of protein* in the diet can no longer be regarded as the primary factor in the causation of this disease.

In conclusion, the writer wishes to acknowledge the more than active interest shown by Professor J. B. Buxton in the work, and also to express his thanks to his colleagues, Mr. T. J. Bosworth and Mr. R. E. Glover, for much help and valuable assistance in making the histological examination of the specimens.

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XUM

Clinical Articles

A Strange Case in a Bull.

By T. W. HUGHES, M.R.C.V.S.

Mold, Flintshire.

SUBJECT.—A 2 year old Shorthorn bull, a Royal Show and Welsh National Show winner, and winner of various first prizes. The owner came to the surgery for some tonic powders for him and said he thought he was a little off colour after the Royal Show. A few days previously he was awarded first prize in his class there. He did not improve so I was asked to see him. His temperature was normal; the pulse 80 per minute and weak was the only bad symptom he showed. The dung was normal but he would not take a bit of food. He got gradually worse, a grunt developed when he moved, and it was noticed he showed pain when he urinated. A sample of his urine was examined and kidney trouble was diagnosed. Per rectum a large mass could be felt. He died about a fortnight after we first saw him. *Post-mortem* revealed the right kidney 60 lbs. in weight and the left 72 lbs. The remarkable thing was he showed no previous symptoms and was in prime condition.

The normal weight of an ox kidney is about 26 ounces.

A Case for Diagnosis.

By T. W. HUGHES, M.R.C.V.S.

Mold, Flintshire.

THREE years ago I bought a 16-2 hands, 6 years old, blood hunter very cheap. His history was bad and he was given to a friend of mine who let me have him for next to nothing. I took him as a pure gamble. The previous season he had fallen and was supposed to have hurt his spine. He had done nothing for 12 months. The symptom he showed was a peculiar stiffness varying in degree. When my friend first got him he gave him a little canter and a few minutes afterwards he could not move. Strange to relate the horse was sound when he arrived at my place. It was the month of October and he was put into regular work. All went well for about three weeks. Then my assistant and I had him out with another horse and went about 2 miles across country at a nice gallop. After breakfast the groom came to tell me that the horse in question was in great pain. I found that this was the case. He was sweating and looked as if he had got tetanus. These symptoms he had regularly shown with my friend before I got him. But it was remarkable that the next day he was sound and went to exercise. A week afterwards I took him hunting. On the way to the meet he went

XUM

lame behind, but I kept on. The lameness disappeared. He had a hard day and came home sound. He averaged three days a fortnight through the season and kept sound. I sold him the next season and he has since won a number of point to point races and hunt chases. Can anyone suggest what his trouble was? He received no treatment of any kind as I had no idea what was the cause of his ailment. I may add I have seen him many times since, but he has had no further attack.

Some Clinical Cases from Somaliland.

By T. A. COCKSEDGE, M.R.C.V.S.,
Chief Veterinary Officer, British Somaliland.

Primary Iritis in a Foal.

A SIX-WEEKS-OLD foal, bred in the Stud Farm, was brought to me with the history of eye-trouble. On examination two points were immediately noticed; there was no conjunctivitis and there was what looked, on first examination, very like hypopyon. As there was a medical officer on the spot who is somewhat of an eye specialist, I asked him to come and have a look at it. He was delighted and, as I had to go off to another district, he very kindly took charge of the case for me, with, I am glad to say, excellent results, as to-day the colt is doing excellently and apparently has quite normal sight. The line of treatment taken was to thoroughly wash out the eye with silver proteinate, followed by irrigating with normal saline in order to be sure the whole organ and surroundings were thoroughly clean, and one per cent. atropine sulphate drops put in finally. The eye was kept covered and for the first four days poultices were applied in the evening. The colt was sent back to the grazing ground in about a month.

Dislocation of the Shoulder in Cow.

By EUSTACE J. LAINÉ, M.R.C.V.S.,
Guernsey.

SUBJECT.—Young Guernsey cow near calving for the second time.

On April 27th the owner found the animal, which was alone in the byre, very lame. He led her on to some pasture a few yards away, and, finding she could hardly walk, sent for me. Examination showed dislocation of the right shoulder joint, and manipulation proved that reduction was impossible without casting. As the patient was so heavily in calf I advised leaving the operation till after the calving, and prescribed slow movement of the limb, constant bathing, and the application of a cooling lotion several times a day.

I visited occasionally and though I was satisfied it was better

to wait I could see that the owner was impatient and that he wanted something done. I asked to be allowed to get Mr. G. Foote's advice. He came, examined the cow and was of opinion that nothing could be done till some days after calving.

The calf was born, without help, on May 20th. On May 30th Mr. Foote and I reduced the dislocation as follows : A drench containing chloral hydras was administered and the animal cast on straw in the yard in the usual way ; the injured leg being uppermost. The patient was secured by girth ropes to an iron pipe driven between three and four feet into the ground. Padded ropes were then fixed to the limb above the knee and above the fetlock. Six stout men were then asked to put steady but heavy traction on the limb and by jumping on the arm in stockinged feet (as described by Williams), when the leg was fully drawn reduction was effected. When released the animal, which had left the shed on three legs, ran away with two men hanging on to its halter. A blister was immediately applied and every subsequent visit revealed that the reduction had been a complete success. I have seen the cow, a valuable one, several times since, and at the present time it would be impossible to say that there had ever been anything amiss with her.

Some Variations in the Number of Ribs in Pigs.

By D. J. ANTHONY, M.R.C.V.S., D.V.S.M.

Messrs. Marsh & Baxter, Ltd., Brierley Hill.

A RECENT inquiry from the University of Saskatchewan, Canada, has prompted me to pay some attention to the numbers of pairs of ribs in pigs of various breeds, and I have been rather astonished at the variation existing, even in pigs from the same litter.

Text books of Veterinary Anatomy give the number of ribs in the pig as " usually 14 pairs, and sometimes 15 pairs." Few people connected with the pig industry seem to have any idea as to the variation occurring in the different breeds. To the Anatomist this variation in the number of ribs in pigs may be of little interest, but to Bacon Curers it is of great practical value, in that more ribs mean a longer side of bacon. In the production of the " ideal " bacon pig it is important to pay attention to the length of side, and some curers, who are also breeders of pigs, maintain that the Welsh and Large White breeds give long sides of bacon, whereas the Middle Whites and Lincolnshires, etc., give a short side. Every Breed Society upholds its own particular breed as the " ideal," with the result that one finds all sorts of pigs entering English Bacon Factories. There is an utter lack of that uniformity which characterises the Danish and Irish Bacon pig.

XUM

The following is a list of 292 pigs whose ribs were counted by myself, and although it is far from complete as regards some breeds, yet it gives an interesting sidelight on the variations occurring in certain types. I have only included animals whose breed was known beyond any doubt.

Breeds.	No. of pigs examined.	No. of pairs of ribs.		
		14 pairs	15 pairs	16 pairs
PURE BREEDS—				
Large White	10	8	2	—
Middle White	54	27	25	2
Welsh	54	16	36	2
Large Black	10	8	2	—
Lincolnshire Curly-coated	41	34	7	—
Berkshire	3	3	—	—
Gloucester Spot	2	—	2	—
Wessex Saddlebacks	13	8	5	—
CROSS BREEDS—				
Large White Boar x Welsh sow ..	13	7	6	—
do. do. x Middle White sow	2	—	2	—
Large White x Essex	6	—	5	1
Large White x Large Black	3	3	—	—
Welsh Boar x Large White sow ..	12	—	9	3
do. x Cross-bred sow ..	57	22	28	7
Tamworth x Gloster spot	12	8	4	—
TOTALS	292	144	133	15

Visceral Gout in Poultry.

By G. MAYALL, M.R.C.V.S.

IT is questionable whether visceral gout in the fowl is as well known among poultry pathologists as it deserves to be. It is an interesting disease, and the only one that I know of that covers the liver, heart, pericardium, pleuroperitoneum and the serous coverings of other organs with an extensive white deposit which has been likened to hoar frost, chalk or plaster of Paris. The deposit is really urate of soda. The malady is said to occur in birds kept confined, such as pigeons and in birds of prey in the Zoological Gardens and in cage birds and is met with also in guinea fowls, pheasants, ducks and geese. The heavy breeds of fowls such as the Brahma and Cochin China are considered to be most predisposed to it but I have found it in the Leghorn, Plymouth Rock, Rhode Island Red, Ancona, White Wyandotte and Black Minorca.

THE CAUSES are giving food rich in protein, one sided feeding and insufficient exercise. Few of the birds I have examined have received meat, but many of them excessive quantities of wheat, oats, barley or

maize. Gmelin attributes the inclination of fowls to gout to be due to their ability to deal largely and quickly with nitrogenous food (70 per cent. of which is secreted as uric acid). The secretion of the urate on the surface of the serosa causes no inflammatory condition. It is brought about in a reactionless way and thanks to the presence of a stasis transudate it passes out from the well-filled capillaries and veins of the subserosa. The blood plasma rich with uric acid comes on the surface and there the uric acid loses its solvent (acid phosphate of soda) and is deposited. In the sediment only a little fibrin, put out at the same time, is imbedded.

Symptoms.

Visceral gout is not often recognised during life, but there may be weakness, loss of appetite, diarrhœa, lack of good condition and a dark blue colour of the comb.

THE POST-MORTEM SYMPTOMS are usually quite plain. In addition to those previously mentioned the kidneys are often enlarged and sprinkled throughout with white uric acid crystals. The heart and pericardium may be fused together. On the intestinal mucosa and endocardium uric acid crystals may sometimes be seen.

MICROSCOPICALLY. The chalky concrement may be rubbed down with water or very dilute hydrochloric acid and when examined, fine needles in radiated form, or sheaf-like bundles of uric acid crystals may be seen. A more delicate and interesting test is to rub up the material to be examined (e.g. some of the white deposit) in a porcelain mortar with a few drops of concentrated nitric acid and dry it by slow heating, when a reddish bulbous residue is formed. This residue turns purple red on the addition of a drop of ammonia and blue violet on the addition of a drop of sodium hydrate (murexide test).

TREATMENT is to change the food and put the fowls out on grass; green food is advocated and not much corn—sodium bicarbonate, lithium sulphate, tincture of colchicum or salicylic acid as pills are medicinal remedies to be advocated.

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Lehrbuch der Geflugelkrankheiten—Dr. Richard Reinhardt, 2nd Edition.
Maladies des Volailles—Dr. J. Lahaye, 1928.
Poultry Diseases—Dr. B. F. Kaupp, 3rd Edition.
A Manual of Clinical Chemistry—Dr. M. Klopstock and Dr. A. Kowarsky.

XUM

Abstracts of Current Literature

Eber, Professor, of Leipzig.—Can Bovine Tuberculosis be countered by Preventive Vaccinations?—*Deutsche Tierärztliche, Woch,* May 12th, 1928.

THE problem of antituberculous immunisation with the help of attenuated tuberculous virus has been the object of numerous and varied researches; but von Behring has been the first to create an active immunity against Koch's bacillus. The bovo-vaccine of von Behring with a base of attenuated human bacilli, introduced intravenously, the Tauruman of Koch, Schütz, Neufeld and Miessner, the antiphymatol of Klimmer, the process of Heymans, of undoubted efficacy in laboratory tests have not been able to produce a like sufficient immunity against natural infection in the cowsheds. The processes have gradually fallen into desuetude; but some years after the war two new vaccination procedures have claimed attention: (1) The vaccine Calmette-Guérin, the B.C.G. constituted by *living absolutely avirulent* bacilli; (2) the process of Selter, Knauer, and Blumenberg using *living and attenuated bacilli.*

Calmette and Guérin are of opinion that, under the action of B.C.G. a symbiosis of Koch's bacilli takes place, living and avirulent, with the cellular elements, a symbiosis which activates the resistance of the organism so long that living bacilli persist in the lymphoid milieu. The immunity disappears when the bacilli have been eliminated by the natural ways. The vaccination, considered harmless, ought to be repeated each year.

What of the theory of Calmette? The B.C.G. reinforcing the resistance of the organism against the bacillus of Koch for a year, the result obtained is identical with that which was procured by the bovo-vaccine of Behring, the tauruman of Koch, and the antiphymatol of Klimmer. We do not yet possess data concerning the efficacy of B.C.G. in bovines arrived at the period of active sexual life; but it is likely that the B.C.G. with an aggressive character less violent than the bovo-vaccine and tauruman will not give better results than those obtained by the use of the two German vaccines. It is to be feared that the repeated injection of B.C.G. into cows in the lactation period may not be as harmless as in young calves. To sum up, we see no irrefutable tests concerning the efficacy of B.C.G., there is no reason to anticipate a success by its use in the fight against tuberculosis. As for the process of Selter, Knauer and Blumenberg, a living bacillus is utilised, of greatly attenuated virulence by a sojourn of seven weeks in the stove, repeated passages over culture media, and a mechanical

fragmentation by pounding in an agate mortar. The first process tends to avoid the production of any tuberculous lesion, the immunity resulting from a kind of symbiosis, badly defined, between the microbes and the organic cells ; the second tends to the edification of a persistent local lesion, assuring a marked resistance in respect to an accidental infection for as far as living bacilli persist in the lymphatic tissue (the process is no other than that recommended by Vallée since 1911).

The method of Selter is based on the same principle as that of Heymans and it is established that the existence of a local focus does not constitute a sufficient protection. One confirms, on the contrary, the passage of bacilli into the blood, with the production of insidious forms of mammites, difficult to recognise and elimination of bacilli by the milk. On the other hand, the diminution of organic resistance, from whatever cause it may be, exposes to a malign evolution.

It behoves one still to await the age of puberty of vaccinated animals before deciding on the efficacy of the vaccine and also on the question of knowing if the bacilli remain harmless throughout the life of the animal. The process of Ostertag, the accidental ingestion in infected media of very small quantities of bacilli by calves with the production of benign foci of tuberculosis and mobilisation of the organic defence attains the best result sought. Nevertheless, the success of the intervention will depend essentially on the conditions of upkeep of the animals, the absence of all bad treatment and of a permanent control of effectives, with periodical clinical examinations and slaughter of animal carriers with open lesions.

Sjollema.—Pathogeny and Treatment of Milk Fever.—*Tijdschrift voor Diergensknde*, December 1st, 1928.

ANALYSES of the blood of cows affected with milk fever shows that hypoglycæmia is rarely found, that the alkaline reserve is normal, but that the cypher of calcium is diminished (5 mmgr. per 100) as well as the inorganic phosphoric acid.

These facts confirm the theory of Kraus and Zondek, who consider that the disturbances of the regulator mechanism are due in milk fever to a deficiency of calcium ; the sympathetic system has no longer its normal tone and the vegetative functioning is perverted. In big milkers the great needs in calcium and phosphate during lactation would not be satisfied as a result of a parathyroidean insufficiency.

This hypothesis seems to be well founded from the fact that cows affected with milk fever are rapidly cured after an intravenous

XUM

injection of three to 400 cubic centimetres of a solution of calcium chloride at 10 per cent. The action of this last is also favoured by the administration of parathyroidean extract.

From a prophylactic point of view chloride of calcium and vitamin D are to be recommended.

Reviews

Studies on Malaria. By Colonel Sir Ronald Ross, K.C.B., K.C.M.G., F.R.S., Nobel Laureate. Author of "Memoirs: with a Full Account of the Great Malaria Problem and its Solution," etc. London: John Murray, Albemarle Street, W.1. With illustrations. 5s. net.

This is a small and inexpensive book containing the essential facts connected with the author's work on malaria commenced in 1895, and described at length, with other matter in his *Memoirs* of 1923.

The first chapter mentions previous discoveries and speculations on malaria, with the object of his own researches. The author then proceeds to describe the first stage of his investigation in India which led to the fundamental discovery of the "Pigmented Cells" in 1897; and proceeds with a description of his researches which disclosed the whole general life-history of the malaria-parasites in mosquitoes early in 1898.

Chapter IV describes the confirmations and extensions of his work in Italy in 1898, and in Freetown in 1899. The details of his numerous attempts to get his discovery applied for the prevention of the disease and the saving of human life in many countries are given in the rest of the work, beginning with Sierra Leone and West Africa.

Chapter IX mentions the American discovery of 1900 regarding yellow fever and mosquitoes, and Chapter XIII deals with the classical case of malaria-control by mosquito-control at Ismailia in 1902. The work of Gorgas at Havana and Panama is summarised, and then follows Chapters connected with Greece, Mauritius, India, Cyprus, and the War and after, when Sir Ronald was Consultant in Malaria at the War Office, concluding with recent tours in Ceylon and India.

Chapter XX is concerned with his "Studies on Pathometry," that is, the *quantitative* study of infectious diseases.

The last Chapter supplies a useful summary of facts about malaria, which will be specially valuable to planters and others who are forced to live in malarious areas.

A useful bibliography and an index complete a work which the author was asked to publish by many correspondents in India and elsewhere at a low price.

There are four full-page photographs, namely, a group of W. C. Gorgas, Sir Ronald Ross, and H. Claye Weeks as the frontispiece; the other three being of Dr. Laveran, Sir Patrick Manson and Sir Malcolm Watson.

Œsophagoscopie bei Hunden und Katzen. By Dr. Heinrich Suchanek (assistant in the Surgical Clinic at the Veterinary College, Vienna).

The object of this research work was to test the practicability of œsophagoscopy, as used in human surgery, for diagnosis and treatment of foreign body—and diseased conditions—of the œsophagus in the dog and cat.

There is an allusion to past and present endoscopic instruments used in human and veterinary surgery; quotations from human and veterinary literature relative to œsophageal diseases and foreign bodies; and from case records of the Vienna clinic during 20 years (1907-26).

The anatomical features are described with particular reference to endoscopy. The writer found no difficulty in passing a straight tube 3 cm. in diameter into the stomach of a German sheepdog. Instruments consist of an illuminator, double observation tubes, one sliding inside the other—both of oval cross-section (these are made in four calibres and variable length); and an instrument for securing and extracting the foreign body—which is passed through the observation tube. A fine swab carrier and a stomach juice pump complete the apparatus.

The patient is to be deeply narcotised by a drug that does not cause emesis. Chloral hydrate per rectum—gr. iv.ss per lb. body weight is recommended.

Indications for endoscopy arise after a negative result with X-rays, which only show up metallic and bony, etc., bodies well, and in cases of a small body whose position cannot be with certainty diagnosed by the passage of a sound. In addition, endoscopy provides the only means of diagnosing such lesions of the œsophageal wall as neoplasms, diverticula, stenosis, etc., and except for very large bodies, such as sharp pieces of bone, held up, the instrument that can be passed down the observation tube, can effect removal of the body without the necessity of œsophagotomy, with the advantage that the operator can actually see what he is doing all the time. Clinical case quotations show that œsophagoscopy forms a most useful diagnostic aid and demonstrate the value of being able to use one's eyesight while at the same time securing a body held fast in the œsophageal wall.

The booklet is well written and provided with excellent photographs of the instruments used and coloured pictures of views seen through them.

Correspondence

Our President and the General Election.

The Editor, The Veterinary Journal, *London.*

Dear Sir,—

Although members of the Veterinary Profession belong to different Political Parties, we all realise the importance of having a member of our profession in Parliament, whether he be Conservative, Liberal or Labour.

For years we have been dreaming of the future, but these dreams will never come true if we are content to only dream them. We have been living in our own little sphere doing excellent work chiefly from the scientific point of view but neglecting those big and practical national issues on

XUM

which the prosperity of every member of the Veterinary Profession (particularly the Practitioners) depends.

In our President we have one of the most able men this profession has produced and one who has the welfare of the Veterinary Profession always at heart. He has entered the busy field of Politics in spite of his many other calls, and with his eloquence and expert knowledge of Agriculture and Veterinary matters should prove himself to be a great help to the Country, since such services are so badly needed. The Services of the Veterinary Profession to Great Britain are often underestimated but this country cannot afford to do without them. When we bestow the honour of Presidency on one of our members he deserves all the help we can give him in all his undertakings. The task before him is a great one. There are many ways in which the members of the Profession can help in a matter of this kind. Voters could be influenced in divers ways but there is one simple but practical way of rendering very material assistance, as all who are acquainted with present day elections know. The question of an adequate supply of motor cars on the day of the election is one of the highest importance, and it would be asking little of most of the members of the Profession to send a car on the Election Day. The Constituency which our President is fighting is an extremely large one and an enormous number of cars will be required. Will anyone willing to send their cars, send their names to one of us, or direct to the Liberal Agent, Liberal Club, Oswestry; and please state whether accommodation will be required on the preceding night for the driver and car.

C. Wentworth Elam,
8, Roscommon Street, Liverpool.
W. K. Townson,
30, Lincoln Road, Peterborough.

News

Bovine Tuberculosis Eradication in New York.

The number of animals condemned on account of tuberculosis during the fiscal years ending June 30, 1919, to 1928, inclusive in New York State was as follows:

1919	2,097
1920	6,842
1921	20,702
1922	10,780
1923	33,686
1924	39,149
1925	53,431
1926	63,963
1927	67,631
1928	54,945
Total	353,226

The destruction of these tuberculous animals has reduced the infection in New York State from 28 or 30% in 1918 to approximately 10% at the present time.

Big Waiting Lists in Tuberculosis Eradication.

More than 2,000,000 cattle were on the waiting list for tuberculin testing at the end of 1928. This fact indicates an attitude of effective co-operation on the part of stock raisers and dairymen generally, and also that the 1929 record of tuberculin tests is likely to rank high in comparison with other years.

On January 1, a total of 629 counties in the United States had been recognized as "modified accredited areas, and cattle in accredited herds numbered 2,164,105. More than 23,000,000 cattle are in herds under bureau supervision for the eradication of tuberculosis, and the waiting list on January 1 numbered 2,160,517 cattle. In 33 States the demand for testing has outstripped the facilities for prompt response to applications, but the work of testing is proceeding rapidly. The test was administered to 845,971 cattle in December."

College Clinics.

Clinical work in the Veterinary Department of the Kansas State Agricultural College at Manhattan is constantly increasing in numbers. The following is a summary of the number of cases handled in the veterinary clinic for the past five years:

1923–24	3,599
1924–25	4,488
1925–26	5,764
1926–27	6,964
1927–28	9,841

For the 1927-28 college year there were treated by the clinical staff 439 horses, 2,224 cattle, 4,670 swine, 1,323 dogs, 567 sheep, 361 poultry, 152 cats, 16 goats, and 89 miscellaneous small and wild animals.

Students have actual contact with all these cases.

(*Veterinary Medicine, May* 1929.)

In the United States of America the tuberculosis death rate in the human reached a new low level in 1928, according to the Metropolitan Life Insurance Company. The death rate from tuberculosis in 1928 was 72.1 per 100,000.

(*Veterinary Medicine, May* 1929.)

Value of the New Export Cattle Quarantine Station.

As an illustration of the value to stockowners and pedigree breeders of the new Cattle Quarantine Station, established under the auspices of the Royal Agricultural Society at East India Dock, it is noted that during the week ending May 6th 32 cattle, of the approximate value of £9,000, have been exported to Australia alone. The total number of stock which has entered the Quarantine Station since it was opened on the 4th of April 1928, totals: cattle 347, sheep 126, pigs 60, goats 10.

XUM

Personal

HIS ROYAL HIGHNESS THE PRINCE OF WALES has graciously consented to become the Patron of the National Veterinary Association.

THE heartfelt sympathy of every member of the profession will go out to Sir John McFadyean and his family in the great loss which they have sustained by the death of Lady McFadyean, which occurred on May 3rd.

Lady McFadyean was the daughter of the late Principal Walley of the Royal (Dick) Veterinary College, and had thus spent her whole life in the Veterinary profession, being well known to a very large number of the members.

BY the death of the Earl of Northbrook, the Royal Veterinary College loses not only its Treasurer, but one of its most enthusiastic and active supporters. Lord Northbrook took a prominent part in all Agricultural affairs, especially the side which concerned the fight against disease, and it was one of his greatest wishes to see the erection of the new hospital buildings, laboratories, etc. of the Royal Veterinary College completed. The Board of Governors was represented at the funeral by Sir Merrik Burrell, the Chairman of the General Purposes Committee.

MAJOR-GENERAL SIR JOHN MOORE represented the Royal College of Veterinary Surgeons at the recently held Fifth International Congress of Military Medicine and Pharmacy, which was held in London ; and Lt.-Col. Rainey was selected to represent the National Veterinary Association.

WE welcome the intention to publish shortly a Journal issued by the Royal Army Veterinary Corps, the first number to come out in November, under the editorship of Major A. A. Pryer, D.S.O. Col. W. A. Pallin, C.B.E., D.S.O. is Chairman of the Committee of Management, which also includes Lt.-Cols. Mosley, Gibbs, and Walker, Majors Holmes, Bamford, and Oxspring.

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Letters for the JOURNAL, literary contributions, reports, notices, books for review, exchanges, new instruments or materials, and all matter for publication (except advertisements) should be addressed to the Editor.

Copy of advertisements should be in the hands of the publishers—Baillière, Tindall and Cox—not later than the 25th of the month, or if proof is required, not later than 23rd.

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